# WATER WORKS & SEWERAGE

# MEET THE ANTI-CONTAMINATION DIVISION

Wherever our armed forces are faced with danger of contamination . . . in camp laundries, kitchens, hospitals, shower rooms, footbaths . . . Perchloron is on the job. In addition to these individual tasks, Perchloron offers protection to the water supply of the armed forces, and within the limits of availability, to the water supplies of the nation.

Write today for free Perchloron booklet.

*Penn Salt Manufactures*

**LIQUID CHLORINE**

**for water sanitation and sewage treatment**

*Also*

Anhydrous Ammonia • Filter Alum
Ferric Chloride • Sodium Aluminate
Chloride of Lime • Caustic Soda
and other products

**PENNSYLVANIA SALT MANUFACTURING COMPANY**
*Chemicals*

**1000 WIDENER BUILDING, PHILADELPHIA 7, PA.**

New York • Chicago • St. Louis • Pittsburgh • Cincinnati • Minneapolis
Wyandotte • Tacoma


WATER WORKS & SEWERAGE, April, 1945, Volume 92, Number 4. Published monthly by Gillette Publishing Co., 330 South Wells Street, Chicago, Ill. Per copy, 25c. Subscription rate, United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under act of March 3, 1879.

# WORST NUISANCE IN SEWAGE TREATMENT *Eliminated*

**OVER 1,000 PLANTS INSTALLED COMMINUTORS TO ELIMINATE SCREENING AND SCREENINGS DISPOSAL**

**COMMINUTORS CUT COARSE SOLIDS AUTOMATICALLY UNDER WATER . . . NO SCREENINGS TO HANDLE . . . NO ODORS . . . NO FLIES . . . NO UNSIGHTLY APPEARANCE**

Comminutors provide subsurface, automatic screening and cutting of coarse sewage solids without removal from channel . . . Save manpower required for raking screens and hauling, burial, incineration or feeding screenings to a grinding mechanism . . . Eliminate use of truck for hauling screenings . . . Save tires and gasoline . . . Remove health menace from handling screenings . . . Reduce clogging of pumps and piping and the resulting manpower required to clear them . . . Reduce maintenance requirements on pump by cutting up the large solids that would throw pump impellers and shafts off balance and cause the pumps to wear rapidly . . . Manual attention required only for periodic inspection, cutter sharpening and lubrication.

Visit a Plant Where Comminutors Are Installed. Note Clean Appearance, Minimum Manual Attention and Satisfaction of the Operator.

COMPLETELY DIMENSIONED LAYOUTS AND SEWER FLOW CURVES ARE IN BULLETIN 185-A

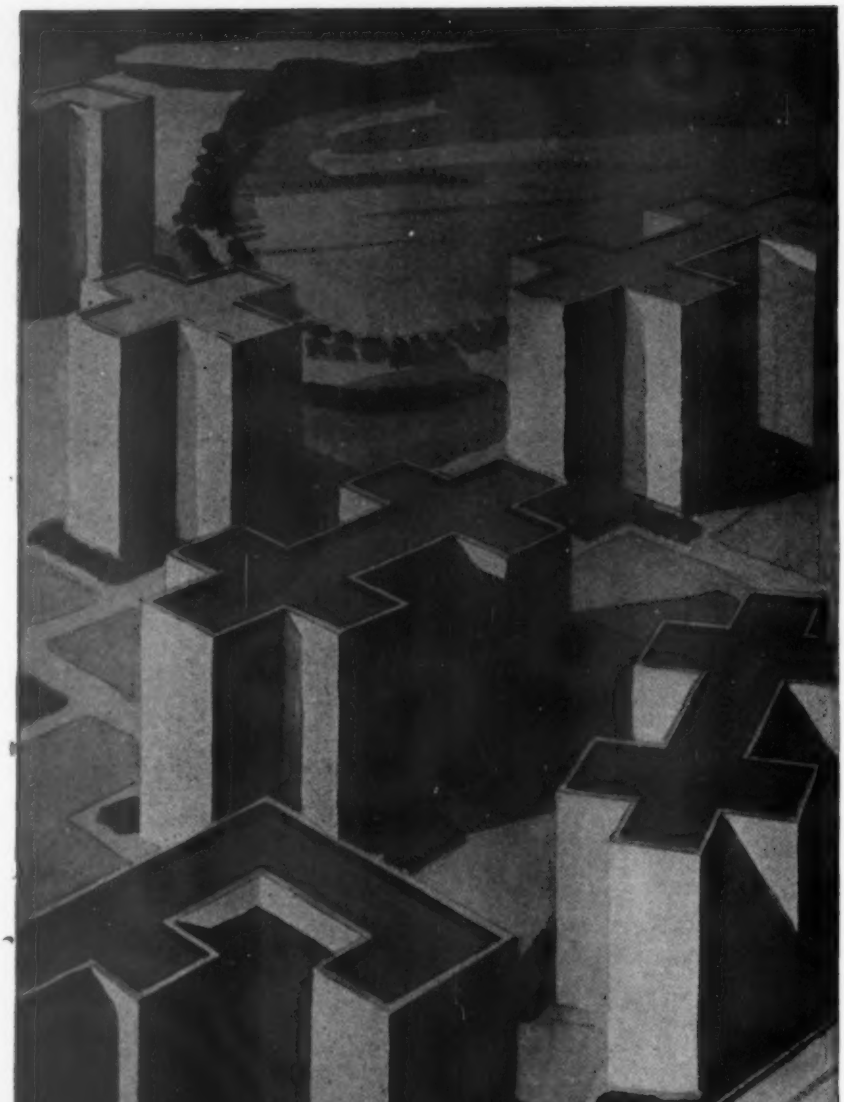
## CHICAGO PUMP COMPANY

**SEWAGE EQUIPMENT DIVISION**

**2349 WOLFRAM STREET** — **CHICAGO 18, ILLINOIS**

Flush Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs, Water Seal Pumping Units, Samplers.

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.



# Is this

Making your city a better place for people to live in—that's your job.

It's a big job—as important as any in man's climb toward better living conditions.

And it's a *great* job!

In the American city of today, material civilization has reached the highest peak in history. Such diseases as typhoid have virtually disappeared. Thanks to your work, thousands of Americans are alive and healthy who otherwise would have died.

Tomorrow's cities will be greater still. And we of General Electric believe that *you* will play a still more vital part in their building.

That's why, having developed what we sincerely believe is *this* century's revolution in municipal sanitation, we want to solicit *your* interest, *your* suggestions, *your* questions, *your* criticisms.

The revolution we refer to is simply this: The elimination of "garbage" in the coming American city. As surely as the outhouse gave way to the flushable toilet, we believe the garbage can will give way to the Disposall—an electric appliance that *converts fresh food-waste into sewage,* and flushes it down the drain!

## Your questions . . . and our answers . . . about the "Disposall" idea

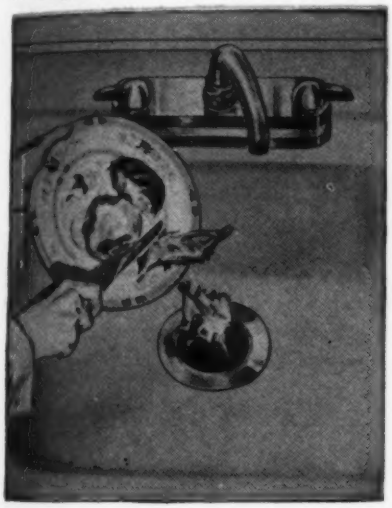
The questions below are typical of questions we have been asked by municipal sanitation authorities, public health officials, engineers, and technicians . . . who, believing the Disposall will be increasingly important in the postwar era, naturally want to know what it will do to their sewers and plants.

The *answers* below are taken from ten years of experimentation and development in outstanding sanitary engineering laboratories, and from home tests in over 300 communities.

# the trend in tomorrow's cities . . . ?

**1. What is the G-E Disposall?**

The General Electric Disposall is a new kitchen appliance. It *converts fresh food-waste* into sewage by shredding it to a size capable of passing easily through sewerage lines, then flushes it into the sewerage system.



**2. Why is that a "Revolution" in sanitation?**

Because, until now, two distinct and independent systems for garbage collection and sewage disposal have existed.

To the average American, the garbage can may seem an unavoidable evil—but so, 50 years ago, did the outhouse. With the Disposall, we believe that *household wastes* can be, should be, and will be instantaneously removed by water-carriage methods.

**3. Aren't food wastes and human wastes different?**

Their differences are slight. Their similarities are many. Both are organic materials. Both are highly putrefactive. Both breed germs and insects, contaminate the atmosphere, and are detrimental to public health and comfort.

Both should be removed for sanitary disposal *as quickly as possible.*

**4. How will the Disposall affect your facilities?**

It won't—in any measurable way—for a long time to come. Your present "sewage" contains just about everything people can conceivably flush down a drain—human waste, dirt, lint, soap, cleaners, coffee-grounds.

There is no "normal" sewage-constituency . . . no new problem posed by the installation of Disposalls.

If the Disposall ultimately becomes universal—as we believe it will—it may require increased *capacity* in your plant facilities.

**5. Will Disposall food wastes clog the sewerage system?**

No. Full material on this—derived from ten years of experimentation, and practical experience in 300 communities—is available on request.

Data shows that the light, fluffy character of the ground solids retains them in suspension without shoaling or settling. Lines are not clogged, or affected in any way.

**6. Is a sewage treatment plant necessary?**

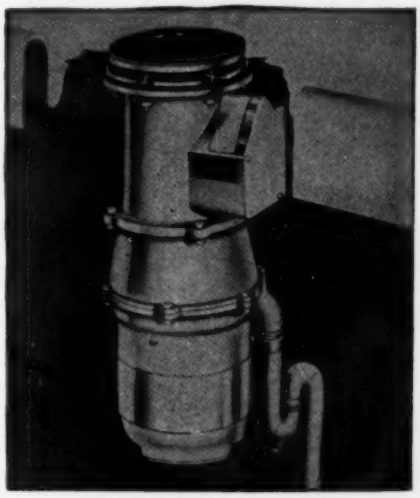
Yes. In our opinion, sewage treatment plants are essential to public sanitation in *any* case.

Increased sewage strength that will ultimately be caused by widespread use of the Disposall will—we hope—help public health officials in their battle to obtain such plants. The Disposall is one *more* good reason for sewage treatment.

**7. Will the present treatment system work?**

Yes. Tests show that wastes from the Disposall settle, digest, and react generally without significant difference from other city sewage.

Sludge-gas, too, can be utilized without change. In fact, the total gas heat value will greatly *increase,* with widespread use of the Disposall.

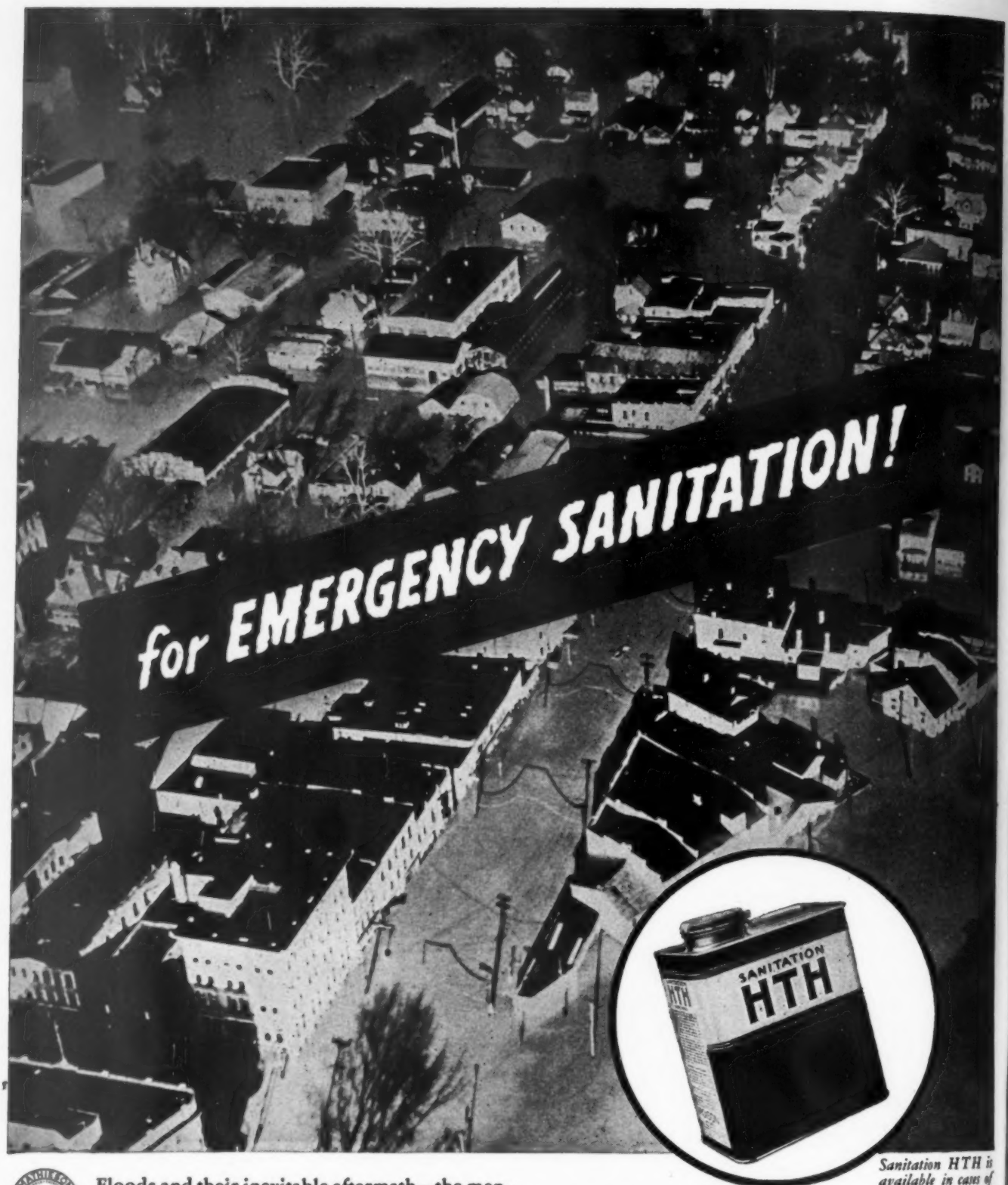


**We will be glad to send you more complete data and information, on request —or to answer any specific questions you may have. Please write to Dept WWS-445, General Electric, Schenectady 5, N. Y.**

GE Disposall

*CONVERTS FOOD WASTE TO SEWAGE—ELIMINATES "GARBAGE"*

GENERAL ELECTRIC




Floods and their inevitable aftermath—the menace of epidemic water-borne disease—call for quick and effective action. Countless communities stricken by flood waters know how Mathieson's Sanitation HTH affords prompt chlorination of polluted water supplies—prevents the scourge of disease and makes possible early resumption of safe water service.

Flood threatened communities should maintain adequate stocks of Sanitation HTH to secure the protection its 70% available chlorine provides in meeting flood and other emergency conditions. Check your stock now—and write or wire for an additional supply of Sanitation HTH if required.

*Sanitation HTH is available in cans of nine 5-lb. cans and in 100-lb. drums.*

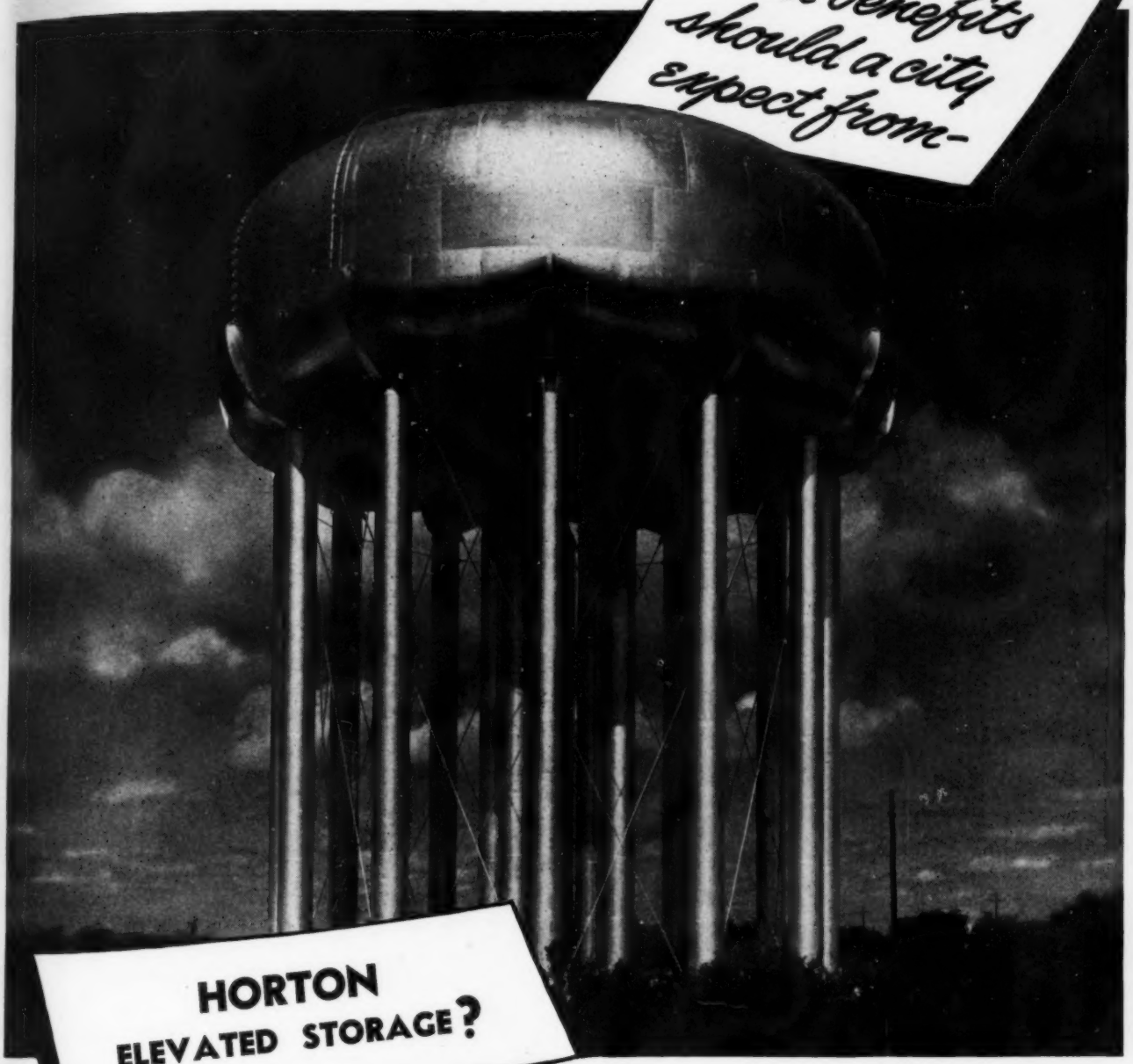
**Mathieson**
CHEMICALS

**THE MATHIESON ALKALI WORKS (INC.)**
**60 East 42nd Street, New York 17, N. Y.**

SANITATION HTH ... LIQUID CHLORINE ... PH-PLUS ... FUSED ALKALI ... CAUSTIC SODA ... SODA ASH ... BICARBONATE OF SODA ... CHLORINE DIOXIDE AMMONIA, ANHYDROUS & AQUA ... DRY ICE ... CARBONIC GAS ... SYNTHETIC SALT CAKE ... SODIUM CHLORITE PRODUCTS ... SODIUM METHYLATE

# HERE'S A FAIR QUESTION - - -

*what benefits should a city expect from-*



## HORTON ELEVATED STORAGE?

● Elevated water tanks are usually installed in municipal water works systems for specific purposes such as improving distribution pressures, providing adequate reserves for fire flow, etc. The total benefits resulting from such installation, however, are often many fold.

Let's look at the job the elevated tank shown above, at San Antonio, Texas, is doing. It is Factor No. 1 in the elimination of wide pressure fluctuations. The capacity of the pumping equipment need not be great enough to take care of maximum demands, for peak loads can be met by the reserve held in the elevated tank. The re-laying of larger transmission mains can often be avoided . . . existing mains need only handle average pumpage instead of peak loads. And there will always be a reserve of water for fire protection.

Progressive city officials and water works engineers . . . those who are constantly on the look-out for improvements to existing water supply systems . . . realize the value of elevated storage. Do you have up-to-date estimates on Horton elevated tanks in your engineering data file? If not, write today, stating your requirements . . . we'll send estimates of cost and information without obligation to you.

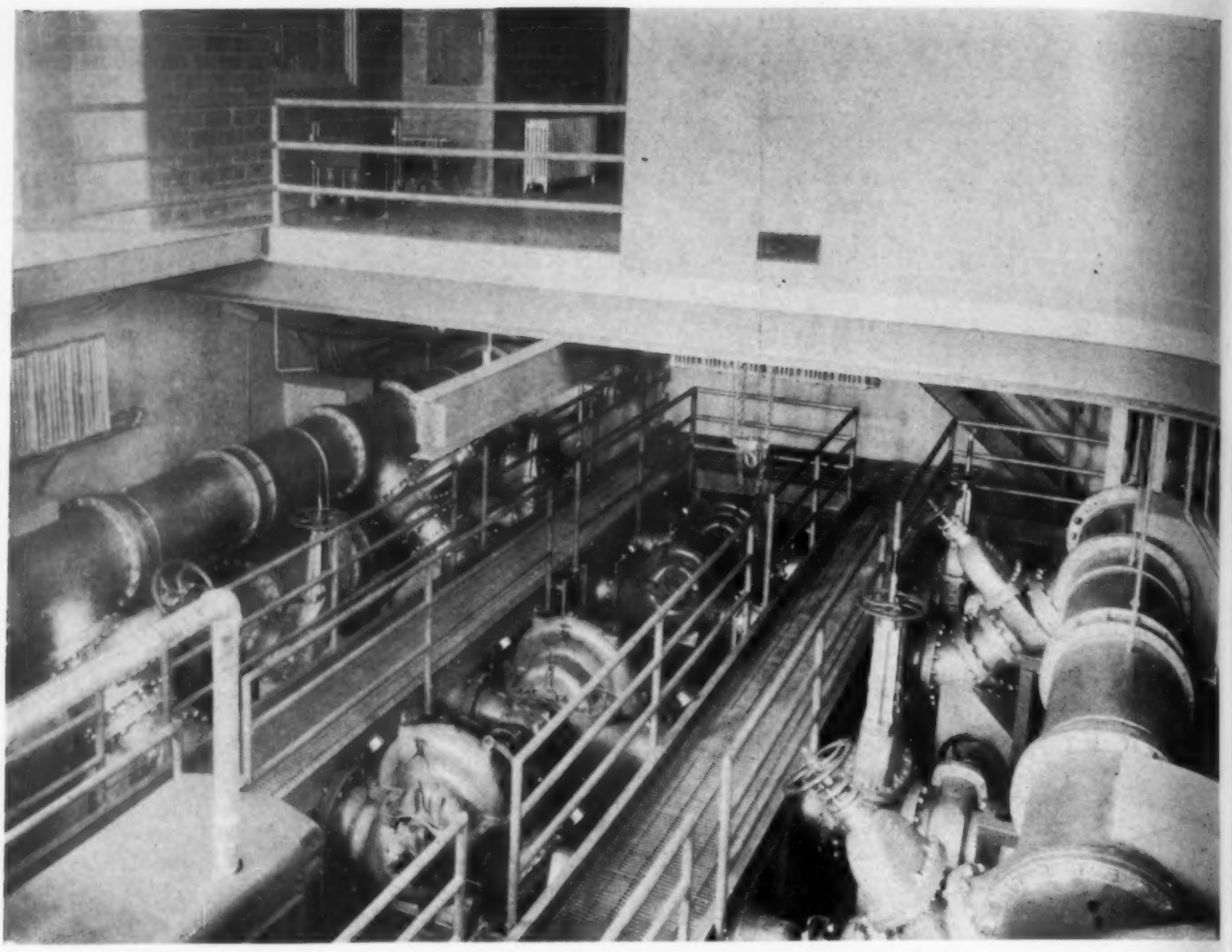
## CHICAGO BRIDGE & IRON COMPANY

Chicago 4.....2198 McCormick Bldg.
New York 6.....3390-165 Broadway Bldg.
Cleveland 15.....2262 Guildhall Bldg.
Los Angeles 14.....1455 Wm. Fox Bldg.
Birmingham 1.....1586 North 50th Street

Plants in Birmingham, Chicago and Greenville, Pa.

Tulsa 3.....1646 Hunt Bldg.
Houston 1.....5615 Clinton Drive
Philadelphia 3.....1644-1700 Walnut Street Bldg.
Washington 4.....703 Atlantic Bldg.
San Francisco 5.....1083 Rialto Bldg.

In Canada: Horton Steel Works, Limited, Fort Erie, Ont.



ANOTHER EXAMPLE OF

HIGH PRESSURE CONTROL STATION — WATERBURY, CONN.
3 De Laval water turbine driven pumping units, 3 m.g.d., 5 m.g.d. and 7½ m.g.d. each at 105 feet head.

# UNDIVIDED RESPONSIBILITY

In 1941 the City of Waterbury through their consulting engineer, Malcolm Pirnie, designed a new building for their high pressure station together with new intake, all pumping equipment, station piping, chemical feed, auxiliary gasoline engine drive, etc.

One contract for all of the above completely erected was awarded to Turbine Equipment Company.

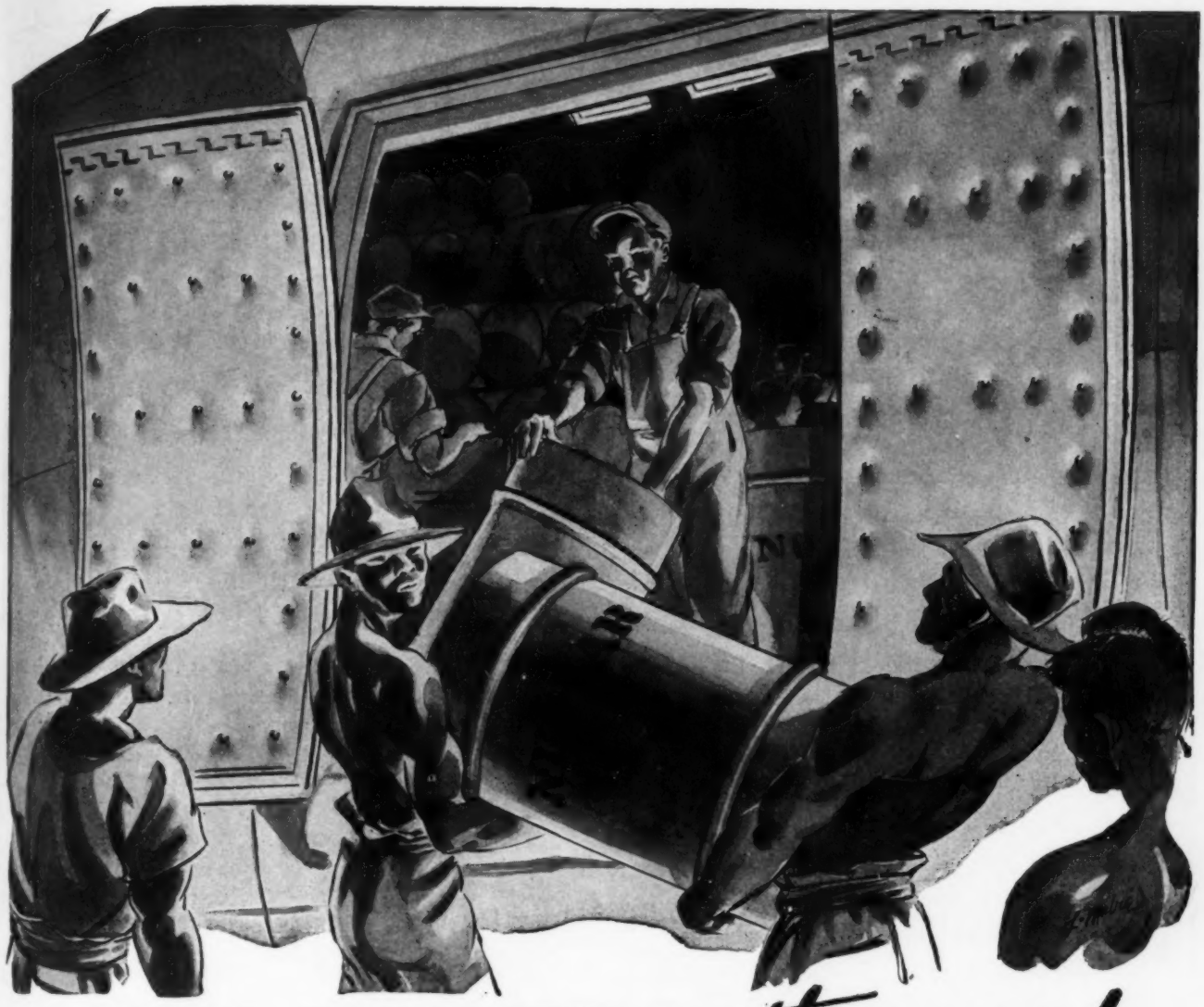
Turbine Equipment Company with 36 years of experience as equipment contractors are in a position to give you the same advantages of undivided responsibility in the installation of complete water works and sewage equipment.

## TURBINE EQUIPMENT COMPANY

75 WEST STREET — NEW YORK 6, N. Y.
80 Federal St. — Boston 10, Mass.

*REPRESENTING AND SERVICING*

DE LAVAL STEAM TURBINE CO.
DE LAVAL SEPARATOR CO.
PEERLESS PUMP CO.
YEOMANS BROS. CO.
COCHRANE CORP.



# AQUA NUCHAR'S *on the move!*

On fighting fronts the world over, the S. O. S. are receiving an S-O-S from our forces for stocks of Aqua Nuchar Activated Carbon! Yes, an important item on Service of Supply's list is the activated carbon that purifies water by *ad*sorption.

Our army and navy receive clear, palatable water—and Aqua Nuchar's role is even more important when you remember that activated carbon is doing a big share in the job of making water safe and palatable for our advance fighting men and field hospitals.

Aqua Nuchar, at home or abroad, is *the* method of purification, because it works on the *ad*sorptive principle—trapping algae and other aqueous impurities in the many faceted surface of each microscopic particle of carbon.

For your community and for Uncle Sam's vast city of service men, Aqua Nuchar is economical because small amounts of Aqua Nuchar work wonders. Yes, in the community the cost of Aqua Nuchar Activated Carbon has proven to be less than two cents per year.

Write or wire for information today. An Aqua Nuchar representative will be glad to call on you.

**BLUEPRINT NOW!**

But above all, remember there is a war yet to be won. Maintain equipment to assure operation at 100% efficiency.

NUCHAR — INSURES PALATABLE DRINKING WATER

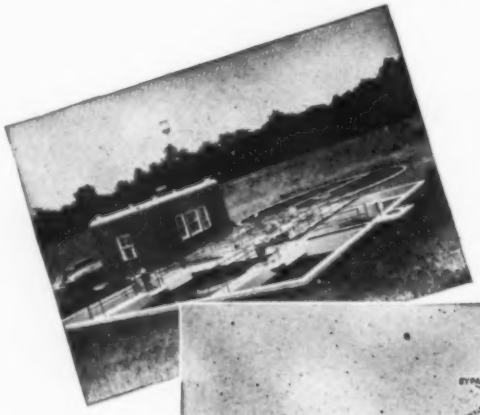
**INDUSTRIAL CHEMICAL SALES**

DIVISION WEST VIRGINIA PULP AND PAPER COMPANY

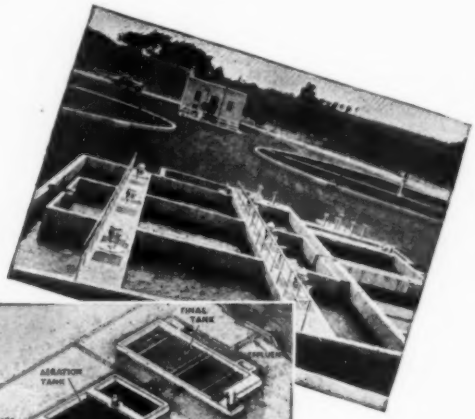
230 PARK AVENUE, NEW YORK 17, N.Y. · 35 E. WACKER DRIVE, CHICAGO 1, ILLINOIS · 748 PUBLIC LEDGER BLDG., PHILADELPHIA 6, PA. · 844 LEADER BLDG., CLEVELAND 14, OHIO

# American Bio-Activation

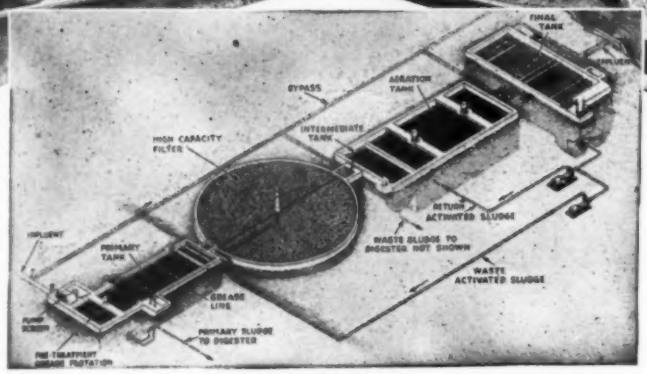
## WASTE TREATMENT



COVINGTON
OHIO



CHILTON
WISCONSIN




FLOW SHEET

***Bio-Activation*** combines the best qualities of both the trickling filter and the activated sludge process to produce a completely stable, nitrified effluent, low in B. O. D. and suspended solids.

### TYPICAL OPERATING RESULTS

| | Domestic, Malt, Brewery and Canning Wastes | |
|---|---|---|
| | 5 BOD | Suspended Solids |
| Raw Waste | 342 | 370 |
| Primary Effluent | 235* | 134 |
| Influent to Filter | 510† | ..... |
| Filter Effluent | 99 | 143 |
| Intermediate Effluent | 58 | 65 |
| % Reduction Filter Influent through Intermediate Effluent | 89.5 | ..... |
| Final Effluent | 13 | 15 |
| % Overall Removal | 97.5 | 96 |

*High Soluble 5 BOD from malt and brewery.
†Pea waste; 600-1200 ppm. 5 BOD, added in primary effluent.

***Blue Print Now!—Send for Bulletin No. 259***

AMERICAN
ESTABLISHED ..... 1868

THE AMERICAN WELL WORKS

*Manufacturers of*

PUMPING · SEWAGE TREATMENT · WATER PURIFICATION EQUIPMENT

RESEARCH · ENGINEERS · MANUFACTURERS · *Factory and Laboratories* ··· AURORA, ILLINOIS

# *Pure Water*

**made safe through the use of**

## DIAMOND LIQUID CHLORINE

CHLORINE

An important job—safeguarding the purity of water supply—is aided materially by the dependable uniformity and purity of DIAMOND LIQUID CHLORINE.

In the manufacture of DIAMOND LIQUID CHLORINE, all processes are under accurate control at all times, assuring consistently high quality of the finished product. For complete satisfaction, specify DIAMOND.

**DIAMOND ALKALI CO.**

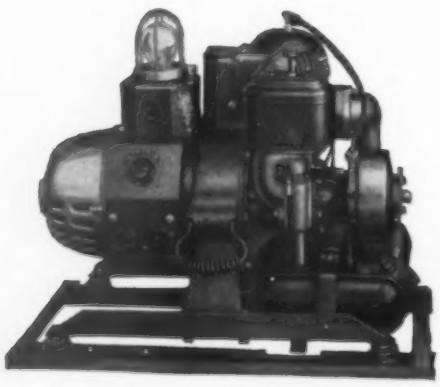
Pittsburgh, Pa. and Everywhere

# DIAMOND LIQUID CHLORINE

# LIGHT

**BRIGHT**
*and*
**RIGHT**

**Only 100 pounds complete, a Homelite Gasoline-Engine-Driven Generator has the power to furnish plenty of electric power . . . 2000 watts . . . enough to operate the brilliant floodlights you need for night emergency repairs.** *



* A Homelite Portable Generator is *right* from the standpoint of design and construction. Light, compact, rugged, easy to start, easy to operate, easy to keep in top condition, and extremely dependable at all times.

* Just one of many uses for a Homelite. Send for our new booklet showing all the time-saving uses of Homelite Portable Generators, Pumps, and Blowers.

**HOMELITE CORPORATION**
*Portable* **PUMPS • GENERATORS • BLOWERS**
PORT CHESTER, NEW YORK

If your community owns its water supply system and installs pipe bearing a mark like this, you and your fellow taxpayers should be gratified because that mark identifies cast iron pipe, known as "Public Tax Saver No. 1."
CAST IRON
CAST IRON PIPE SERVES FOR CENTURIES
CAST IRON PIPE SERVES FOR CENTURIES
it will stay on the job
the ground for 100 years, serving
CAST IRON
which identifies cast iron pipe, otherwise known as Public Tax Saver No. 1.
CAST IRON PIPE SERVES FOR CENTURIES

Reproductions of advertisements (shown in reduced size) appearing in TIME and NATION'S BUSINESS.

## SO MERIT SHALL BE RECOGNIZED

Because cast iron pipe is used so extensively in the public service—for water, sewer and gas mains—the members of Cast Iron Pipe Research Association identify their product to the public by the "Q-Check" mark stencilled on each length of pipe. Cast iron pipe has been advertised to the public for more than twenty years and is becoming widely known as "Public Tax Saver No. 1." Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, Peoples Gas Building, Chicago 3, Illinois.

CAST IRON PIPE SERVES FOR CENTURIES

# THESE METER FEATURES WON THE BIGGEST CONTRACTS!

## *3 Reasons Why* WORTHINGTON-GAMON *Meters Were Specified*

The largest water meter contracts ever awarded in the United States named "Watch Dog" meters.

This choice is due to these facts:

1. Worthington-Gamon has the longest experience of any water meter manufacturer—a fact which suggests superior performance over the longest life.
2. Manufacturing controls established not just for meters, but for a broad line of Worthington equipment used by municipalities, provide greater assurance of low-cost maintenance.
3. Constantly-improved Worthington-Gamon meter designs have developed an unusual ability to measure accurately even the smallest quantities of water.

No other water meter manufacturer maintains as extensive service facilities as Worthington-Gamon—24 district offices in 24 leading cities. Worthington water meter technicians and Worthington Research Laboratories will help you work out a plan for better, lower-cost metering.

*Subsidiary of*

**WORTHINGTON PUMP AND MACHINERY CORPORATION**

Power Plant Equipment • Turbines & Turbo-Generator Sets • Condensers, Heaters, Ejectors • Water Purification Equipment • Pumps, Stationary and Portable Compressors • Air Conditioning & Refrigerating Equipment • Power Transmission Equipment • Construction Machinery, Equipment for Mines • Locomotive Feedwater Heaters • Welding Positioning Equipment • Liquid Meters

**WORTHINGTON-GAMON METER COMPANY**

282-296 South Street, Newark, New Jersey

WG 4-5

The Meter Specified in the Largest Contracts Ever Awarded in the U. S.

"Watchdog" models . . . made in standard capacities from 20 G P M up; frostproof or split case in household sizes. All parts interchangeable with your present meters of our manufacture. Write for Bulletin.

# It's easy to tap Lock Joint Pipe — under pressure

**LOCK JOINT**
*Reinforced Concrete*
**PRESSURE PIPE**

TAPPING a branch connection into a Lock Joint Reinforced Concrete Pressure Pipeline is accomplished quickly and easily by means of a simple arrangement of saddle and sleeve castings clamped to the pipe with steel bands.

No highly specialized technique is required and the work can be done by regular water works employees with their own equipment.

For further information on making connections under pressure to existing Reinforced Concrete Pressure Pipelines, you'll find the Lock Joint Pipe Company at your service.

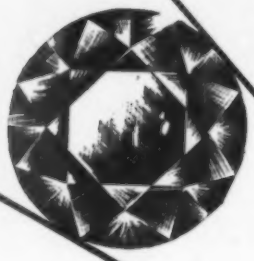
**LOCK JOINT PIPE COMPANY**

*Established 1905*

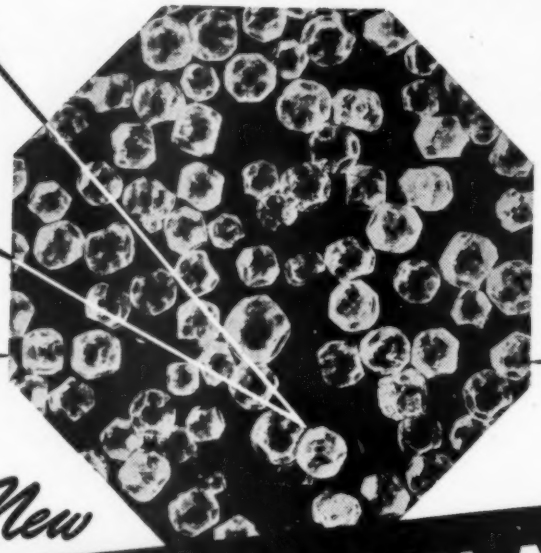
**P. O. BOX 269, EAST ORANGE, N. J.**

Denver, Colo. • Chicago, Ill. • Kenilworth, N. J. • Kansas City, Mo. • Rock Island, Ill.
Joplin, Mo. • Valley Park, Mo. • Cleveland, Ohio • Hartford, Conn. • Navarre, Ohio

**SCOPE OF SERVICES** *Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Mains as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.*



*Diamonds...?* **NO!**



Potash Alum Crystals: 5 diameters

*The New*

**STANDARD GRADE CRYSTAL ALUMS***

*by General Chemical*

**For WATER COAGULATION**

Standard Grade

**LUMP**

of same high chemical quality as rice and granular sizes. Especially for use in water plants employing "solution pot" feeders.

The searching eye of the photomicroscope finds gem-like form and brilliance in General Chemical's new Standard Grade Ammonia and Potash Alums. . . . Examine this unretouched enlargement. Note the *unusually uniform size, shape and complete formation* of the crystals. Here are superior physical characteristics which make these General Chemical Crystal Alums outstanding for many industrial operations. They are free flowing without dusts or fines . . . have faster, more uniform rates of solution . . . handle better in conveying equipment and feeding systems.

In addition to visual perfection, the chemical purity built into these alums is held to standards comparable to fine chemical specifications—without increased cost to consumer. The new processing techniques yielding this superior quality are another achievement of General Chemical's continuous research and development of Basic Chemicals for American Industry.

**CRYSTAL ALUM, AMMONIUM**
★ Rice, thru 8 on 30 Mesh
★ Granular, thru 10 on 60 Mesh

**CRYSTAL ALUM, POTASSIUM**
★ Rice, thru 10 on 30 Mesh
★ Granular, thru 30 on 60 Mesh

And In New Containers: Fiber Drums, net wt. 360 and 100 lbs.
Multiwall Paper Bags, net wt. 100 lbs.

Standard Grade Lump and Powdered sizes have same high chemical quality.

U.S.P. GRADE: Conforming to requirements of pharmacopeia in all respects . . . available in all sizes.

BASIC CHEMICALS

GENERAL CHEMICAL COMPANY

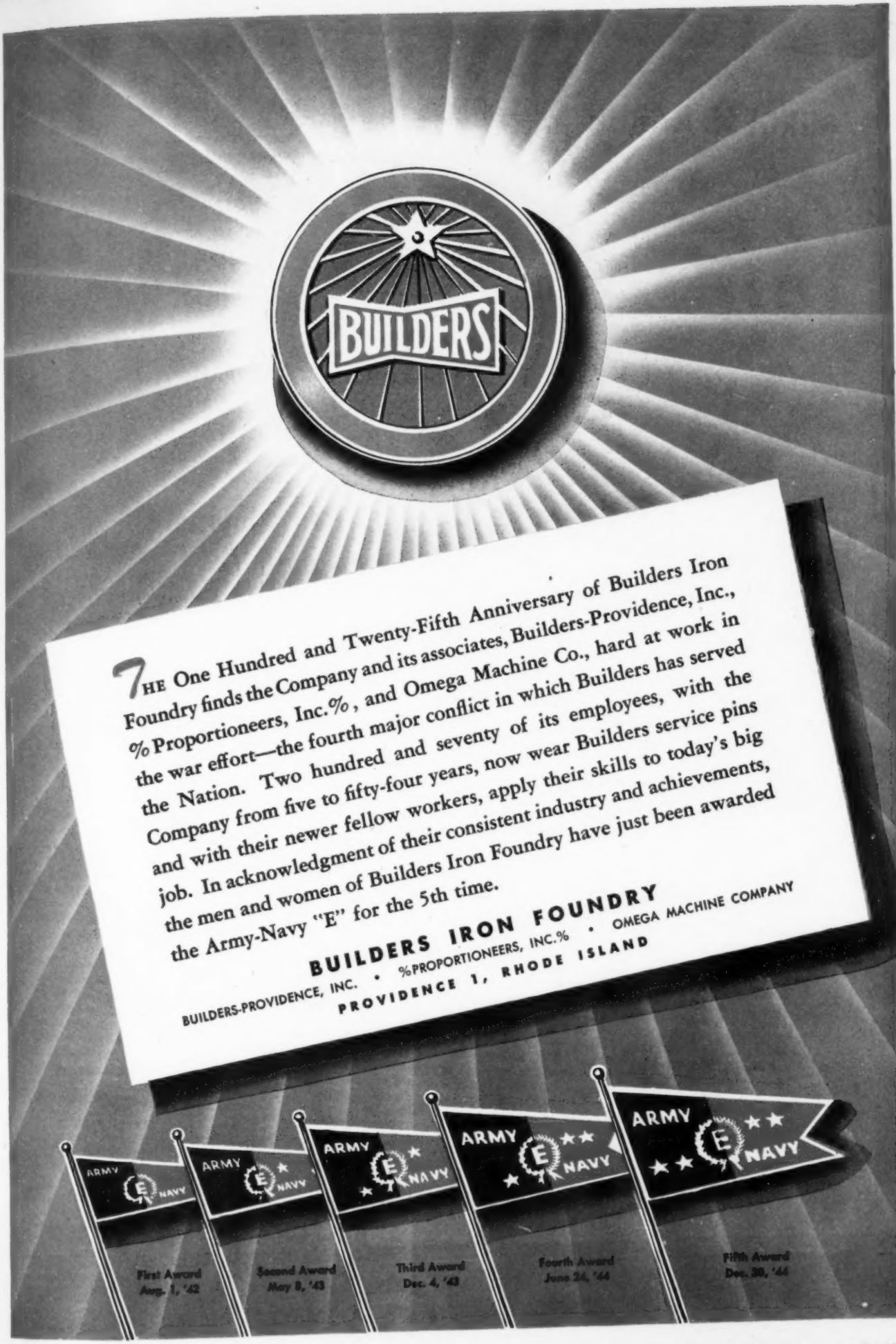
FOR AMERICAN INDUSTRY

**GENERAL CHEMICAL COMPANY**
**40 Rector Street, New York 6, N. Y.**

*Sales and Technical Service Offices:* Atlanta • Baltimore • Boston • Bridgeport (Conn.) • Buffalo • Charlotte (N. C.) • Chicago • Cleveland • Denver • Detroit Houston • Kansas City • Los Angeles • Minneapolis • New York • Philadelphia Pittsburgh • Providence (R. I.) • San Francisco • Seattle • St. Louis • Utica (N.Y.) Wenatchee • Yakima (Wash.)

In Wisconsin: General Chemical Wisconsin Corporation, Milwaukee, Wis.

In Canada: The Nichols Chemical Company, Limited
Montreal • Toronto • Vancouver


BUILDERS
THE One Hundred and Twenty-Fifth Anniversary of Builders Iron Foundry finds the Company and its associates, Builders-Providence, Inc., %Proportioneers, Inc.%, and Omega Machine Co., hard at work in the war effort—the fourth major conflict in which Builders has served the Nation. Two hundred and seventy of its employees, with the Company from five to fifty-four years, now wear Builders service pins and with their newer fellow workers, apply their skills to today's big job. In acknowledgment of their consistent industry and achievements, the men and women of Builders Iron Foundry have just been awarded the Army-Navy "E" for the 5th time.
BUILDERS IRON FOUNDRY
BUILDERS-PROVIDENCE, INC. • %PROPORTIONEERS, INC.% • OMEGA MACHINE COMPANY
PROVIDENCE 1, RHODE ISLAND
ARMY E NAVY
First Award Aug. 1, '42
Second Award May 8, '43
Third Award Dec. 4, '43
Fourth Award June 24, '44
Fifth Award Dec. 30, '44

GESS—ORIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—ORIGIN

# BURGESS MARINE SNUBBERS for Diesel Exhaust Noise Control

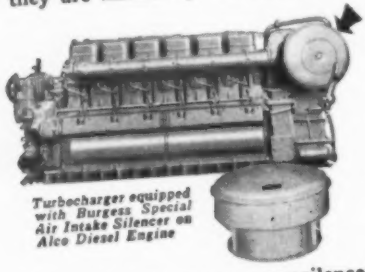
## EFFECT OF SPECIAL INTAKE SILENCER ON SUPERCHARGED DIESEL ENGINES

It is the opinion of many in the Diesel field that, by the end of the present war, all new 4-cycle Diesel engines will be equipped with mechanically-driven or with exhaust gas driven superchargers (turbochargers). At the present time, most Diesel engine manufacturers supply their engines to suit the customer's specifications . . . either supercharged or non-supercharged.

It is possible to install turbochargers on 4-cycle engines without radical changes in engine design or construction. These usually consist of alterations to gears and camshaft.

The purpose of the supercharger is to increase the mean effective pressure. This is accomplished by compressing more air into the cylinders. The intake valves are timed to open sooner, and the incoming air rushes in under pressure. The cold air stream absorbs heat from the top of the cylinders and pistons, and provides for the burning of more fuel without overheating.

While turbochargers will increase the power rating of the Diesel engine, they are inherently and necessarily noisy In sound tests, some unsilenced turbochargers have reached a noise level of 130 decibels, which corresponds to the sound of a wartime air raid siren at close range



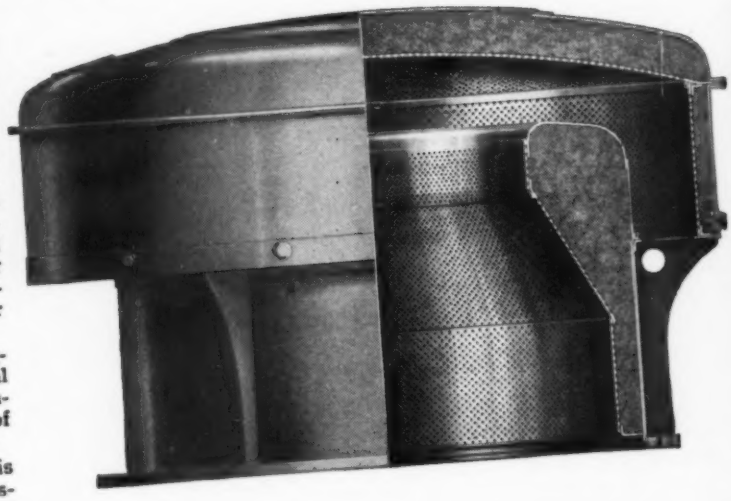
*Turbocharger equipped with Burgess Special Air Intake Silencer on Alco Diesel Engine*

To suppress the noise of Diesel superchargers, Burgess-Manning has developed the Burgess Special Air Intake Silencer (indicated by the arrow on the Alco Diesel Engine). It completely subdues the air intake whine of the supercharger. In the words of one Diesel engine manufacturer . . . "The noise level of our turbocharged engines has been reduced so that the difference between a supercharged and a non-supercharged engine is not noticeable, except when standing immediately adjacent to the turbocharger."

The inner sections of the Burgess Special Air Intake Silencer are packed with acoustic material and covered with perforated metal. The venturi type entrance reduces restriction to air flow and it increases sound absorption within the silencer by exposing the sound that leaves the turbocharger to the maximum area of acoustic material.

*Close-up of Burgess Special Air Intake Silencer showing venturi type entrance and perforated metal inner liner.*

Since superchargers are so desirable for improving engine performance, it is fortunate that the air intake noises can now be subdued to the vanishing point. A Burgess-Manning Special Air Intake Silencer is an essential accessory to every well-engineered supercharged Diesel installation, and all Diesel engine designers and operators should be thoroughly acquainted with the construction and action of this important noise-suppressing unit.



## DO YOU HAVE BACK PRESSURE PROBLEMS?

Back pressure problems are characterized by poor engine efficiency, excessive intake or exhaust noise, overheating, and similar ills that beset Diesel engine operation. They may be caused by intake or exhaust pipe of improper length, faulty methods of silencing, or by improper installation of silencing equipment in the air intake or exhaust line.

Manometer readings measure back pressures . . . determine the pulsating flow in exhaust and intake systems. However, a simple manometer cannot tell the whole story.

The Burgess sampling manometer differs from the simple manometer, because it measures the pressure at intervals of a few degrees throughout the complete engine cycle. By plotting the pressures throughout the complete cycle, a true analysis of pressure conditions can be made.

The Burgess manometer test is helpful when the Diesel operator suspects insufficient air flow is "starving" the engine or compressor. The opposite is also true with overheated Diesels which may be caused by an abnormal supercharging condition.

If there is any doubt regarding harmful back pressure effects on your Diesel engine, it may be helpful to consult a Burgess-Manning engineer. He will gladly co-operate in the study of your back pressure problems.

**Published by BURGESS-MANNING COMPANY Chicago, Illinois**

COPYRIGHT 1944—BURGESS-MANNING COMPANY

ESS—ORIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—ORIGI

COMPLETE SATISFACTION IN EXHAUST AND INTAKE QUIETING—SPECIFY BURGESS SNUBBERS—FOR

# Source of "Firsts"

*Modern Research Laboratory at Niagara Plant as interpreted by the artist, John Gaydos*

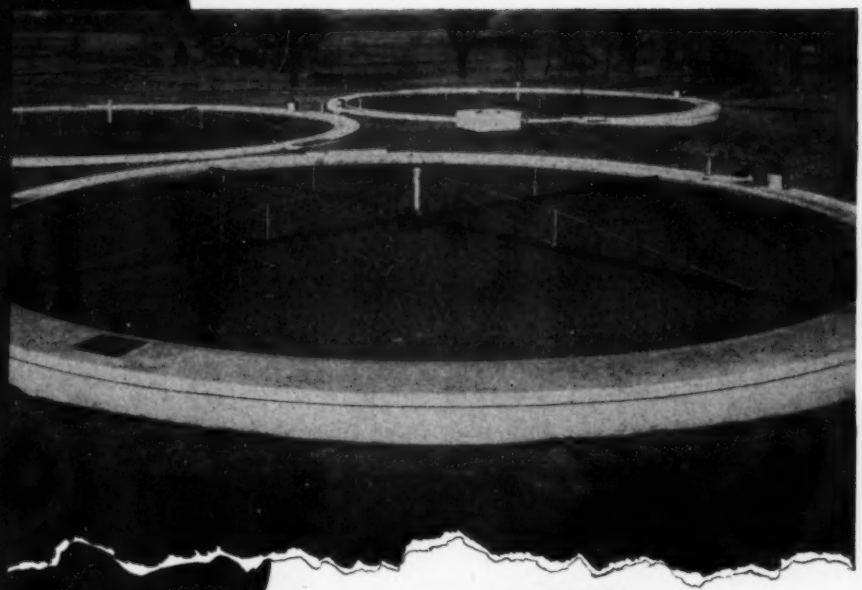
THE FACT that Niagara was the first to produce several important electro-chemical products in this country is due in great part to the efficiency of its research. Niagara's research activities are under the supervision of men of long and thorough experience in electro-chemical development, manufacture, and usage. This has enabled Niagara to give valuable cooperation to many industries using such products in the processing of war materials. It will prove of equal value in helping these industries convert efficiently to peacetime manufacture. Look to Niagara for experienced chemical service.

**Niagara ALKALI COMPANY**

60 EAST 42nd STREET, NEW YORK 17, N. Y.

# When DISTRIBUTOR ARMS are a maintenance problem

MAINTENANCE TIPS FOR CORROSIVE SEWAGE SERVICES



...ROUGHT IRON

Every plant that uses trickling filters fed by rotary distributor arms can expect corrosion attack on the equipment, and unless preventive steps are taken, maintenance is likely to be necessary early and often.

As in most services in a disposal plant, the most practical method of avoiding frequent repairs to these arms is through the selection of proper materials. And as in most services in disposal plants, Byers Wrought Iron has earned a real reputation for durability. The illustration shows an installation at work in a midwest locality. In Texas, wrought iron was used in a distributor with 88-foot radial arms, as well as for part of the center column. Other noteworthy installations have been made in Missouri and in Pennsylvania. Generally wrought iron has been used for the incidental connecting lines, as well.

Wrought iron has been a long-time favorite with designers interested in assuring maximum trouble-free service at minimum annual cost, and with operating men who seek maximum freedom from repairs and replacements. The reason why wrought iron serves so well is found in its unique structure. Hundreds of thousands of tiny fibers of glass-like silicate slag are threaded through each square inch of section of the main body of high-purity iron. When corrosive attack occurs, these fibers act like a system of baffles, to halt and diffuse it. This discourages the local pitting and quick penetration that cause ordinary materials to fail. The fibers also help to anchor the initial protective scale that shields the underlying metal. And when galvanizing or other protective coatings are used, the character of the surface of wrought iron aids it to take and retain a heavier application.

Several distributor installations are illustrated in our bulletin, "Wrought Iron for Sewage Treatment and Disposal Installations," and there is a lot of helpful and interesting information in addition. We will be very glad to send a complimentary copy, on request.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

For
- LIFETIME PERMANENCE
- LOW FIRST COST
- LOW MAINTENANCE COST
- GUARANTEED SATISFACTION

Capitol Heights, Md.—1,500,000-gallon P DM Steel Reservoir

Berryville, Va.—Two 3,000,000-gallon P·DM Steel Reservoirs

# Specify Steel Reservoirs by PITTSBURGH · DES MOINES

In planning for water storage by reservoir, where supply and topographic conditions are favorable, be sure to combine the natural advantages and economies of this type of storage with the outstanding benefits of *steel* reservoir construction. Pittsburgh-Des Moines Steel Reservoirs are permanently strong and watertight—unaffected by weather or seasonal change—can be erected at any time of year—require only an infrequent coat of paint to retain new appearance, and are lower in first cost than other construction types. With a definite, responsible guarantee of satisfaction, P·DM Steel Reservoirs end your water storage problems upon installation—and *keep* them solved! *Write for descriptive Bulletin 102. Consultations gladly arranged on request.*

tlantic, Iowa—Two 0,000-gallon P·DM el Reservoirs

Bottineau, N. D.—1,000,000-gallon P·DM Steel Reservoir

**PITTSBURGH·DES MOINES STEEL CO.**

PITTSBURGH, PA., 3418 NEVILLE ISLAND—DES MOINES, IOWA, 919 TUTTLE STREET
NEW YORK, ROOM 921, 218 BROADWAY · CHICAGO, 1222 FIRST NATIONAL BANK BUILDING
DALLAS, 1223 PRAETORIAN BUILDING · SAN FRANCISCO, 625 RIALTO BUILDING
SEATTLE, 526 EIGHTH AVENUE, SOUTH

# NEW PUMPS PAY

## MODERN DE LAVAL PUMPS

10% to 15% more efficient than older models

*De Laval single-stage, double-suction water works pump*

**A new pump will frequently pay for itself out of power savings within two years or less, so great have been recent improvements in pump efficiency. Let's consider a typical example:**

| | |
|---|---|
| Rate of pumping—3 mgd | Current cost—2¢ kw./hr. |
| Pumping head ft.—231 ft. | Operation per year—5000 hrs. |
| Assumed motor efficiency | 88% |

| | YOUR OLD PUMP | A NEW 1944 DE LAVAL |
|---|---|---|
| Pump efficiency | 72% | 83% |
| BHP | 170 | 147 |
| Electric HP | 193 | 167 |

**Power saved 19.4 kw. at 2¢ rate—38.8 cents/hr. Annual saving—5000 hrs. x .3888, or $1,940.00. A new 1944 De Laval heavy duty water works pump, with 150 hp. driving motor and reduced voltage starter, can be supplied for the sum of $2,448. Thus we have:**

| | |
|---|---|
| *Percentage return on equipment* | 79½% |
| *Time required to repay first cost* | 15 months |
| *Annual saving after liquidation of investment* | $1,940.00 |

**In many cases the cost can be reduced if the existing motors can still be used, making the return much greater. • Now is the time to plan water works improvements. A De Laval representative will be glad to help you work out the details.**

*De Laval Labyrinth wearing rings, sustain high efficiency*

4112

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS and COMPRESSORS • IMO OIL PUMPS

# DE LAVAL

STEAM TURBINE COMPANY · TRENTON 2, NEW JERSEY

SALES OFFICES: ATLANTA • BOSTON • CHARLOTTE • CHICAGO • CLEVELAND • DENVER DETROIT • DULUTH • EDMONTON • GREAT FALLS • HAVANA • HELENA • HOUSTON KANSAS CITY • LOS ANGELES • MONTREAL NEW ORLEANS • NEW YORK • PHILADELPHIA PITTSBURGH • ROCHESTER • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SEATTLE TORONTO • TULSA • VANCOUVER • WASHINGTON, D. C. • WINNIPEG

# What do You call Your Sludge? Nuisance or By-Product!

If you are using either of the first two methods, you should investigate the possibilities of the Royer method of processing sludge so that it becomes a marketable fertilizer instead of a waste product, with a high nuisance value.

The low cost Royer Sewage Sludge Disintegrator shreds, mixes, aerates and further dehydrates sludge in a single, simple operation. At the same time it is reduced to small particles, readily assimilable by soil, and freed of sticks, stones and other trash.

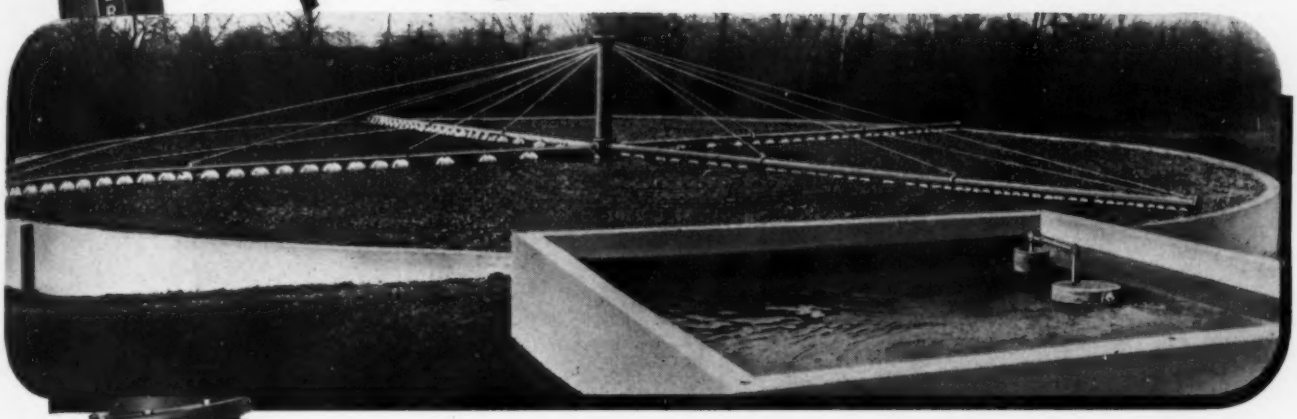
Every community offers a ready market for Royer processed sludge. Its use is recommended on parks, golf courses, cemeteries, private lawns and gardens and all places where there is a need for healthy plant growth. Do yourself and your community a favor. Write today for Bulletin 643 which describes the different sizes and types of Royer Sludge Disintegrators.

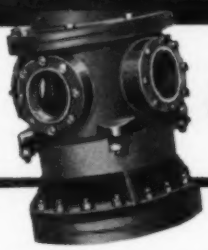
**Royer Foundry & Machine Co.**
**161 Pringle St., Kingston, Pa.**

THE ROYER FOUNDRY & MACHINE CO.
KINGSTON, PENNSYLVANIA

PIONEERS IN THE SALVAGE OF SEWAGE SLUDGE

# CARTER REACTION TYPE *Rotary* DISTRIBUTOR





## FOR TRICKLING FILTER SYSTEM OF BIOLOGICAL TREATMENT

### ADDITIONAL FEATURES

- Oversize ball bearings.
- Adequate lubrication capacity.
- Automatic mercury return.
- Welded construction and standard parts...the better to meet emergency field repairs.
- Extra heavy steel guy rods equipped with turnbuckles for correct arm alignment.
- Automatic alternating siphon—insures correct operation of distributor mechanism.

HERE'S the tried and proven method of treatment that will economically give excellent results with comparatively little attention. Operating data compiled on CARTER normal rate distributors shows:

1. A consistently high removal of B.O.D. and suspended solids.
2. Complete elimination or practical control of filter fly problems.
3. Little or no reduction of efficiency during winter temperatures.

With CARTER units there's no recirculating pumping problems or maintenance; no excessive chlorination or flooding for fly control and . . . no filter clogging.

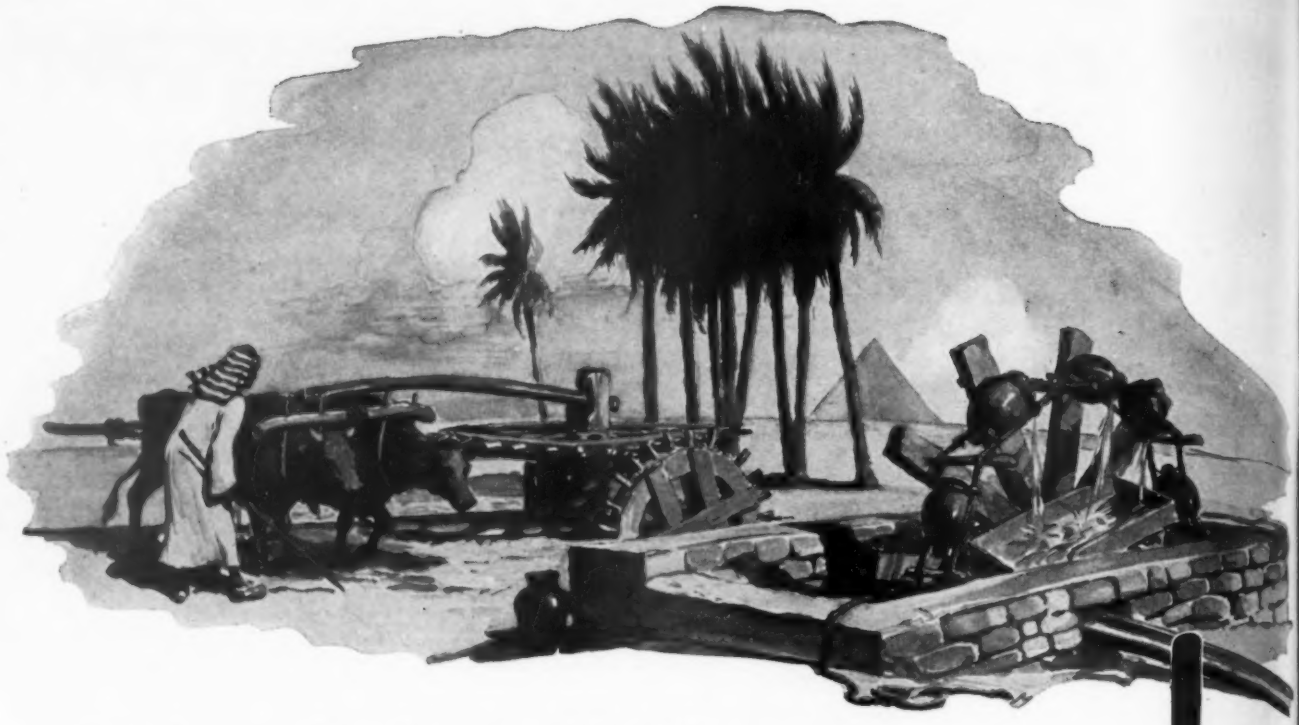
Mechanically the CARTER distributors top the field. Such features as an improved leveling flange that permits column alignment without disassembly of arms, anti-corrosion-proof bronze nozzles and a mercury chamber designed to adequately seal both columns make our distributor a unit worthy of consideration for your next plant.

**Our engineering and testing facilities are always available for technical assistance to our customers. Complete information on this or other CARTER mechanisms for water purification or sewage treatment will be gladly furnished without obligation.**

● *WRITE FOR BULLETIN 4401*

## RALPH B. CARTER COMPANY

Main Office: HACKENSACK, N. J. New York Office: 53 PARK PL., NEW YORK 7, N.Y.



# Today's *Hydraulic* Problems Are Solved by *Science!*

GUESSWORK, crude and makeshift methods in hydraulics are of the past. Now, problems are worked out in advance in our own Hydraulic Laboratories. By constant research the quality and performance of our products are thereby continually enhanced.

Also, by testing models of proposed installations including both intake and discharge passages in conjunction with turbines especially designed to meet the expected operating conditions, exact project efficiency and performance can be predicted. Alterations, if necessary, can hence be made prior to actual field construction or manufacture. Thus it is to your interest to make haste slowly in purchasing hydraulic equipment. Avail yourself of our 70 years of experience and knowledge—and be certain!

*If It's Hydraulics—*
*Put It Up to Us!*

**S·MORGAN SMITH COMPANY**
YORK · PENNSYLVANIA · U·S·A·

**POWER by SMITH**

# PRODUCT IMPROVEMENT THROUGH DURONZE TO DEFY TIME AND CORROSION OVER 100,000 P.S.I.!

The unnecessary waste of manpower, equipment and interrupted service caused by failure of bolts, screws, and other fasteners made from improper materials deserve the serious attention of engineers and manufacturers. With today's progress in engineering alloys, it is not necessary to use materials that waste away from rust or fail without warning due to season or stress corrosion cracking.

For example, fasteners, fittings and connectors made from Duronze average approximately 100,000 pounds per square inch in tensile strength as compared to ordinary materials which when manufactured are approximately 70,000 pounds per square inch and deteriorate rapidly with time. Duronze defies time and maintains its strength and dependability despite moisture, continuous stress, temperature extremes, weathering, smoke and corrosive gases.

Engineers interested in preventing costly failures and reducing maintenance should specify high strength, corrosion resisting Duronze for bolts, nuts, wire and cable connectors; U bolts, cap, machine and wood screws; nails and other fastenings. Duronze is ideal for applications such as power and communication lines; railway signal apparatus; outdoor construction; railway cars, ships, planes; water meters and water works equipment; sewage reclaiming plants, process industries, industrial applications; underground and surface construction.

Contact your nearest Bridgeport Office for complete information about Duronze Engineering Alloys, and write for Duronze Manual, just revised, which contains eighty pages of charts, tables, technical information and practical suggestions for product improvement.

"Bridgeport" BRASS CO.

BRIDGEPORT BRASS COMPANY
BRIDGEPORT 2, CONN. • *Established 1865*

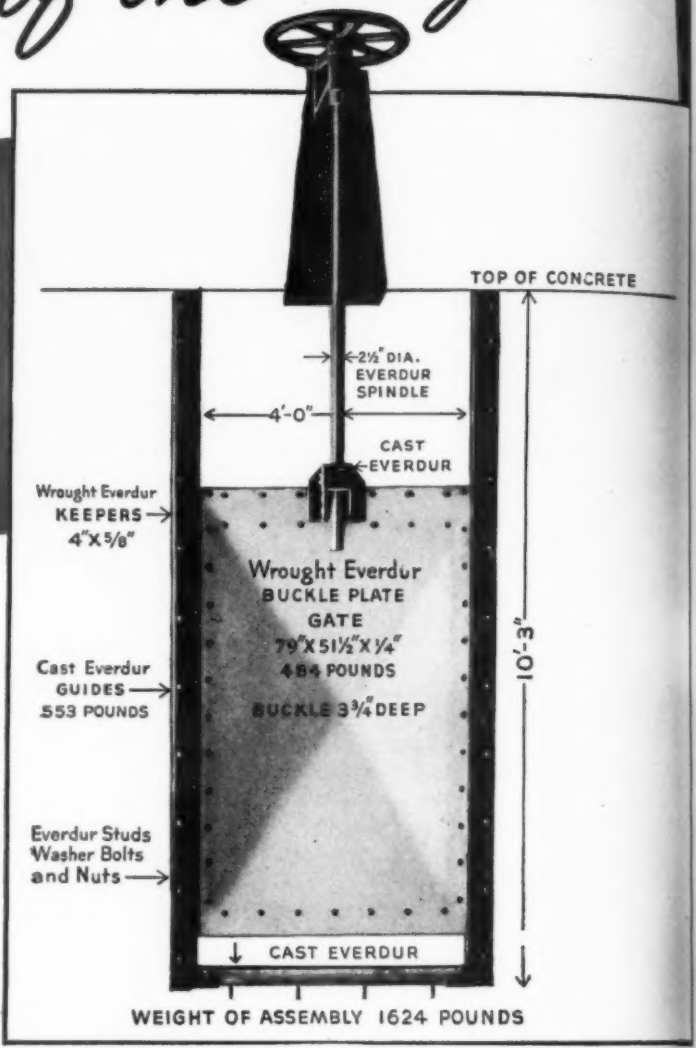
NOTE: *Bridgeport does not make fastenings, but supplies wire and rod to screw and bolt manufacturers.*

*Duronze Alloys* — PRODUCTS OF

**BRIDGEPORT BRASS**

# *One-fifth of the weight*

## PLUS... LONG LIFE LOW COST EASY OPERATION




● Since their installation over ten years ago, five shut-off gates of Everdur Metal* have been giving complete satisfaction in the screen room of the Rahway Valley Joint Meeting Sewage Treatment Works, Rahway, New Jersey.

But long life is only part of the Everdur story. These gates operate smoothly and easily by hand, since their weight is but *one fifth* that of ribbed cast iron electric-driven gates. Everdur provides high strength plus the corrosion resistance of copper, yet is moderate in cost. It is readily welded, worked hot or cold, and is available in practically all commercial shapes.

For detailed information on Everdur Metal in Sewage Treatment, Reservoir and Water Works service, write for Booklet E-11. 44130

*Reg. U. S. Pat. Off.

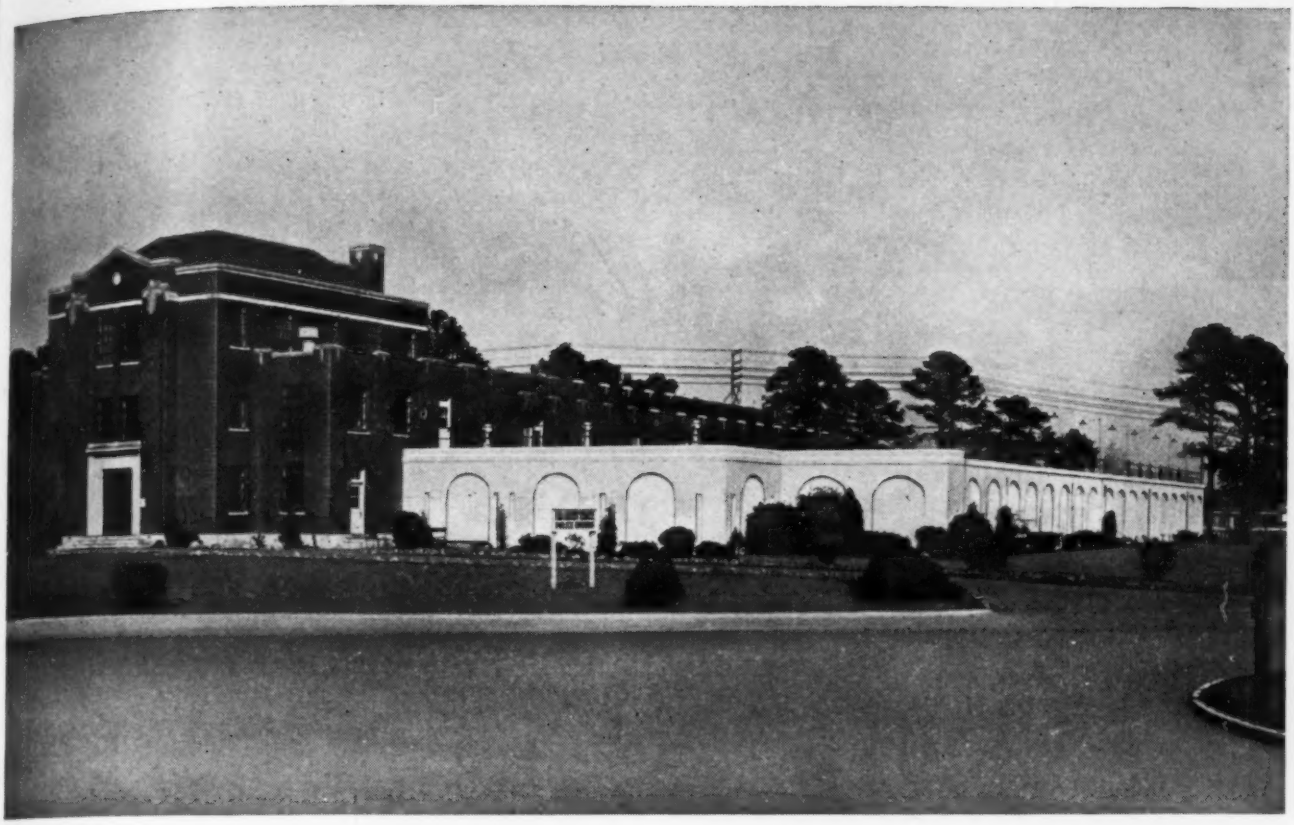
**THE AMERICAN BRASS COMPANY**
*Subsidiary of Anaconda Copper Mining Company*
General Offices: Waterbury 88, Connecticut
*In Canada:* ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

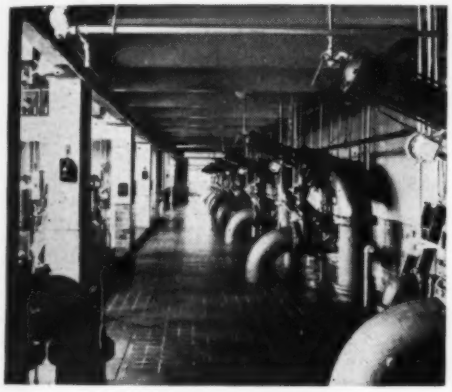
**EVERDUR METAL**

is being used for Coarse and Fine Screens, Swing Gates, Built-up Sluice Gates, Coarse Bar Rack Aprons, Effluent Weirs and Scum Weirs, Structural Scum Baffle Brackets, Troughs, Screen Hoppers, Orifices, Baskets, Anchors, Ladders, Float Gage Chains, Valve Springs, Manhole Steps, Guides, Walkways, Bars and Plates, Bolts and Nuts.

ANACONDA from mine to consumer

*Anaconda Copper & Copper Alloys*





Hydraulically operated valves control the flow through the filter beds.

The filter control tables with the filter beds to the left.

# ROCKY MOUNT CONTROLS CORROSION BY THRESHOLD TREATMENT WITH CALGON*

One of the last water-treatment plants to be built before wartime restrictions were imposed serves the city of Rocky Mount, North Carolina.

This plant is the last word in modern equipment and modern methods, so naturally it employs threshold treatment with Calgon to make sure that troubles from corrosion will not arise.

Since the water, which is pumped from the Tar River, is unusually soft with a pH value that stays close to 7.0, the use of 2 ppm. of Calgon controls corrosion, the water retaining its desirable softness and neutral characteristic.

In hundreds of American communities, Calgon is used in water supply systems to prevent scale, inhibit corrosion, stabilize pH values and prevent the precipitation of dissolved iron — all at extremely low cost.

Let us send you full information about it.

*Calgon is the registered trade-mark of Calgon, Inc., for its glassy sodium phosphate products.*

HAGAN HALL BUROMIN CALGON

**calgon, inc.**

A SUBSIDIARY OF HAGAN CORPORATION

HAGAN BUILDING PITTSBURGH 30, PA.

# The SIMPLEX SAND EXPANSION GAUGE

**PUTS THESE WASH WATER FACTS *At Your Command!***

1. What wash water rate to use for maximum efficiency.
2. How long the proper wash period should be.
3. When optimum expansion has been reached.
4. What velocity and intensity of surface wash is needed.
5. What the optimum requirements of the wash period are.

*Accuracy within 2% of actual sand expansion in all sizes and types of filter beds.*

The Simplex Sand Expansion gauge gives accurate facts about your filter washes which make it possible to arrive at the perfect wash water cycle for any given plant — in any period of the year. The obvious savings in wash water, filter material, time, and labor, make this dependable unit a vital part of your filtration plant equipment. In conjunction with the Simplex Wash Water Controller, the Sand Expansion gauge may provide complete automatic control of the preferred wash cycle.

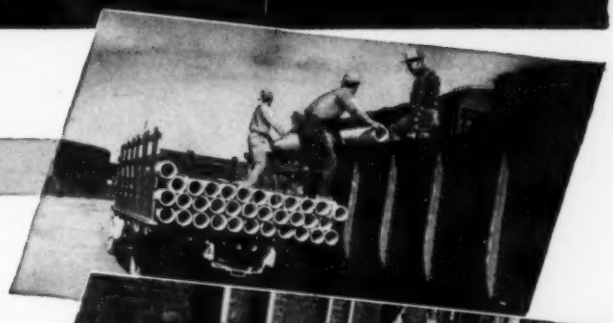
This instrument is as easily installed in plants now operating as in plants under construction. It responds within 2% of the actual sand expansion in all types and sizes of filter beds; gives trouble-free, dependable service, and is low in initial cost.

*Write today for full details on the inherent value of the Simplex Sand Expansion Gauge.*

**SIMPLEX VALVE & METER COMPANY**
**6743 UPLAND STREET, PHILADELPHIA 42, PENNA.**

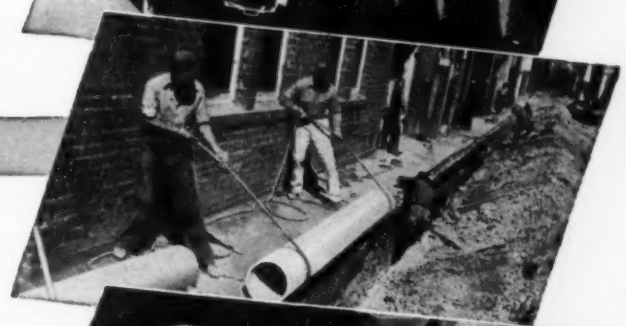
## 1. BIGGER TRUCK LOADS

Right from the start, easy-to-handle Transite Pipe begins to pay off. Its light weight means more footage carried per truck load . . . lower transportation costs.



## 2. SMALLER CREWS

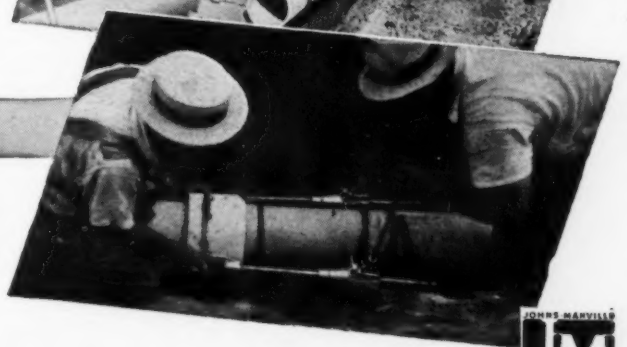
On the job, it takes fewer men to handle Transite Pipe, and smaller installation crews mean lower installation costs. Mechanical handling equipment is not necessary except for the larger sizes.



## 3. FASTER ASSEMBLY

In the trench, Transite Pipe is assembled easily, quickly, even by unskilled crews. Its exclusive Simplex Coupling assures tight joints, even when the line is deflected as much as 5° at each joint.

And in service, Transite Pipe pays off in efficient, dependable water transportation. Made of asbestos and cement, this non-metallic pipe is immune to tuberculation, highly resistant to soil corrosion. Its low maintenance has been proved in thousands of installations.



**Johns-Manville**

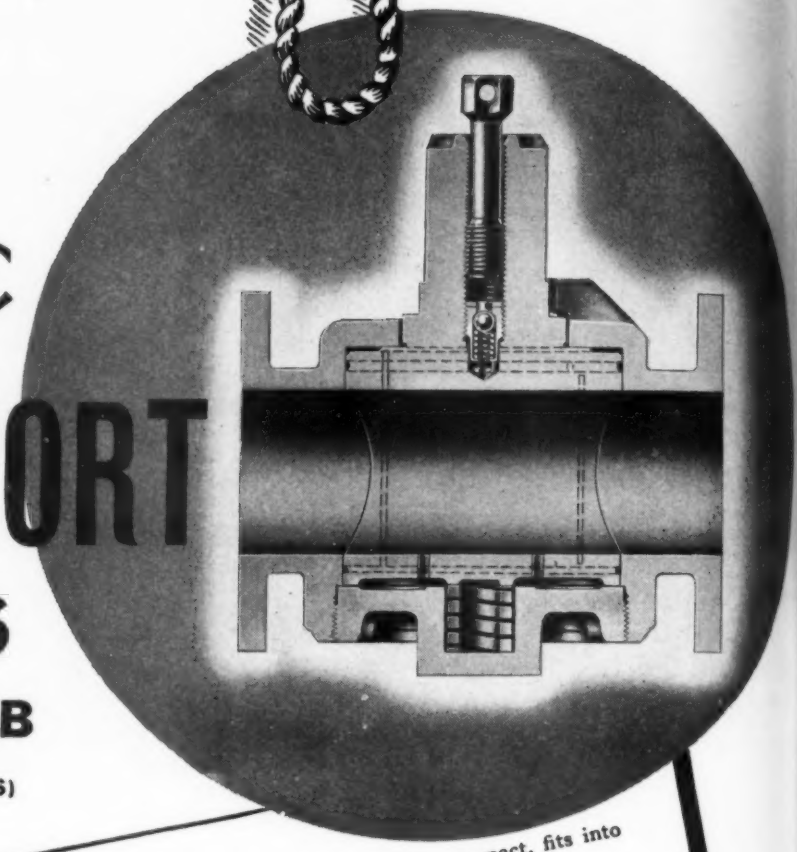
22 EAST 40TH STREET, NEW YORK 16, N. Y.

JOHNS MANVILLE JM PRODUCTS

**TRANSITE PIPE**

FOR EFFICIENT, ECONOMICAL WATER TRANSPORTATION

# Don't use Valves that strangle your pipe lines...



## PUT a.c.f. ROUND PORT VALVES ON THE JOB

**(STRAIGHT THROUGH PLUGS)**

## HERE'S WHY:

- *Full, unrestricted* pipe area handles heaviest, most difficult ladings.
- Quickly opened, valve becomes exact continuation of pipe.
- No change in velocity, area, direction, or cross-section of lading.
- Longer valve life — no abrasive action.
- No pockets in which lading may lodge or cake — lower power and pumping costs.
- Lubricant protects against wear.
- Tight against head leaks under any line pressure — lubricant acts as plastic head gasket and no auxiliary packing is needed.
- Least number of parts — compact, fits into small space.
- No exposed seating surface — minimum corrosion.
- Installed in any position — easily operated and dismantled.
- Go-devils, swabs, etc. may be used for cleaning.
- No special tools required for installation or operation.
- Wrench, spur, or worm-gear types.
- Available in sizes ½" to 8".

Representatives in principal cities carry adequate warehouse stock for quick delivery. Send for Catalog # 3-W.

**"TAILOR-MADE" FOR SEWAGE LINES**

Liquid bearing solids in suspension, such as sewage sludge and [illegible] granulated or similar solids, are easily controlled.

## AMERICAN CAR AND FOUNDRY COMPANY

*VALVE DEPARTMENT*

30 CHURCH STREET, NEW YORK 8, N. Y.

## Accurate Recordings for Revenue Despite Wartime Restrictions . . .

Durability far beyond normal expectancy has been built into Badger Water Meters for 40 years.

Now, under wartime restrictions on critical metals, Badger durability, sustained accuracy and easy interchange of parts are enabling water works men to serve their communities and our Nation at commendably low cost for maintenance and repair.

In your postwar planning, keep in mind the record of Badger Water Meters for durability and sustained accuracy far beyond normal expectancy.

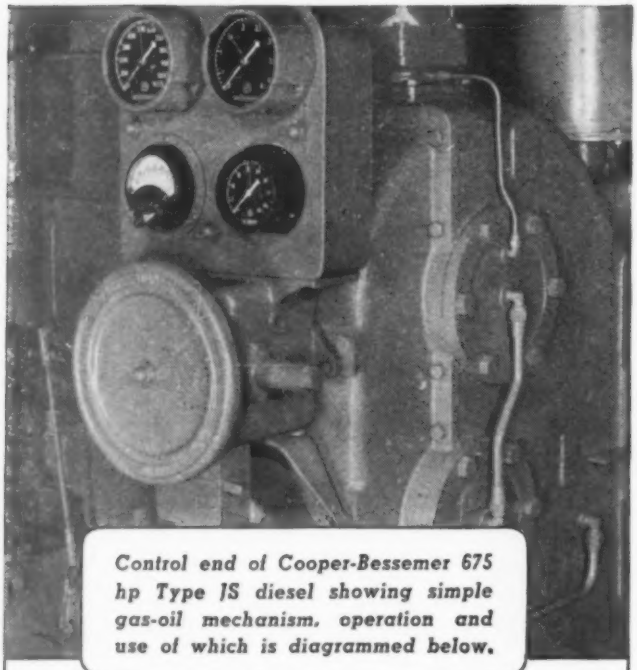
**BADGER METER MANUFACTURING CO., MILWAUKEE, WIS.**

*Branch Offices:* New York City • Tampa, Fla. • Seattle, Wash. • Savannah, Ga. • Kansas City, Mo. Waco, Texas • Los Angeles, Cal. • Chicago Ill. • Philadelphia, Pa.

# *Announcing —*
# *A REVOLUTIONARY ENGINE DEVELOPMENT Of major importance in the sewage treatment field!*

**Ever since 1928, Cooper-Bessemer has been experimenting to perfect a means of using gas as a practical fuel for diesel engines; and to permit instantaneous change-over at full load from gas to oil fuel and vice versa. It can now be announced that these efforts have been completely successful — a truly revolutionary accomplishment.**

## *TO SEWAGE TREATMENT PLANTS, THIS DEVELOPMENT MEANS:*



*Control end of Cooper-Bessemer 675 hp Type JS diesel showing simple gas-oil mechanism, operation and use of which is diagrammed below.*

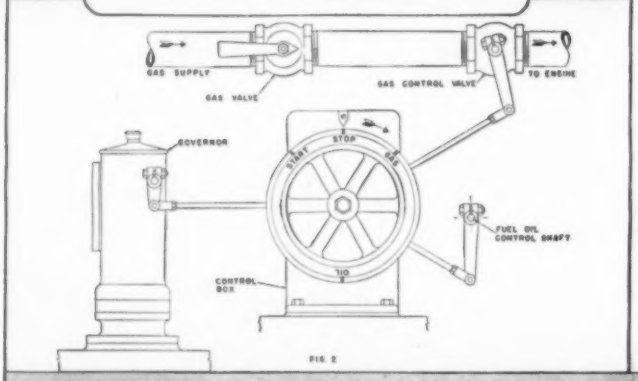



FIG. 2

1. Diesels, with all their inherent advantages, may now be operated on sludge gas in preference to engines of the electrical ignition type.
2. Since the thermal efficiency of a Cooper-Bessemer diesel is so much higher than that of any gas engine of the other type, *20 to 25 per cent less fuel* will be required for the same power output. Or, correspondingly more work can be done with a fixed or limited fuel supply.
3. A single control mechanism permits instantaneous change-over to oil fuel or vice versa *at full load.*
4. Fluctuating or insufficient gas supply may be compensated for by the simultaneous use of both fuels in varying proportion, readily controlled.
5. Change-over or fuel proportion may be *automatically* controlled to conform exactly with gas fuel supply and load requirements.

**Engineers and operating officials will instantly recognize the tremendous economies and revolutionary advantages made possible by this new Cooper-Bessemer development.**

**THE Cooper-Bessemer CORPORATION**

**Mt. Vernon, Ohio • Grove City, Pa.**

**New York Washington Houston Dallas Tulsa Shreveport Los Angeles St. Louis Seattle**

**BUILDERS OF DEPENDABLE ENGINES FOR 112 YEARS**

Drawn for U. S. Pipe & Foundry Co. by Dean Cornwell

# U.S. cast iron PIPE

U. S. PIPE & FOUNDRY CO.
General Offices: Burlington, N. J.
*Plants and Sales Offices throughout the U. S. A.*

**To anyone familiar with recent foundry practice in the production of cast iron pipe, the last frontier of efficiency might appear to have been reached. Yet our research, metallurgical and production staffs are currently developing and perfecting further process and product improvements directed toward still higher pipe quality. Meanwhile, production for war comes first but our plants continue to make and deliver pipe with reasonable promptness.**

YOU CAN'T AFFORD

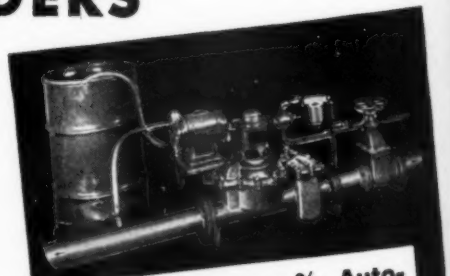
"BY GUESS AND BY GOLLY"

CHEMICAL FEEDING

# %PROPORTIONEERS%

## EXACT, AUTOMATIC, DEPENDABLE CHEMICAL FEEDERS

Hit or miss water treating methods are costly — they often result in dangerous undertreatment, or wasteful overtreatment with consequent disagreeable taste. %Proportioneers% Chem-O-Feeder will soon pay for itself in labor and chemical saved by automatically injecting *just* the right amount of chemical at *just* the right time. The Chem-O-Feeder, controlled by meter, starts, varies and stops feeding of the chemical as the water comes on, fluctuates and tapers off. For further information on safe, economical water treating ask for Bulletin SAN-1.



**%Proportioneers% Automatic and Proportional Hydraulically operated High Pressure Chem-O-Feeder, controlled by standard water meter, to operate against pressures from 60 to 200 lbs. per square inch.**

# WATER WORKS & SEWERAGE

PUBLICATION OFFICE
330 South Wells Street, Chicago, Ill.
E. S. Gillette, Publisher

EDITORIAL OFFICE
155 East 44th Street, New York, N. Y.
L. H. Enslow, Editor


## COMING!

### Naugatuck's Meters Meant Much

Is the story of how water went to war in Naugatuck, Conn. It is told by a water works manager who through universal metering and education of consumers has "stretched" a peace-time ample supply for domestic consumption so that top-flight war industries might be supplied water saved through waste curtailment. How successful the program has been, and how equitable meter rates were developed for meters, registering in gallons, during a year of observation of metered consumer demand without waste, is interestingly told by—

WM. H. MOODY, Pres. and Gen'l Manager,
The Naugatuck (Conn.) Water Co.

### Cathodic Protection in Theory and Practice

Has been covered in articles appearing in our January and February issues and a third article featured in this issue. In our next issue the fourth article further discusses practical applications of the process, with particular emphasis on the protection of hot water systems and refers to application of the process in the protection of deep well casings and screens. This will be the third article by—

L. P. SUDRABIN, Chemical Engr.,
Dayton, Ohio.

### Orifices—Their Selection and Use

Some months ago we promised an article dealing with orifices—their design, construction and use. We have had this treatise on the concentric orifice, with extensive calibration and discharge tables for orifices of various sizes, now for sometime, but with the paper situation what it is, have been unable to print it. However, this reference document has a true value and we expect to print it as soon as permissible—if not in the magazine, then in the Reference and Data Section of our June issue. In the meantime, our regrets and apologies to the author—

D. R. ("Doc") TAYLOR, Major,
Corps of Engineers, U. S. Army.

### Trenching—In Earth; in Rock

One of our good subscribers has pointed out that *Water Works & Sewerage* has published little or nothing in recent years concerning modern methods of trenching in earth or in rock. So we now have something to offer in this category—one article devoted to "Earth Trenching" and a second devoted to "Rock Trenching." These articles have been written by our good friend and valued contributor—

RICHARD BENNETT, City Engr.,
Phoenix, Ariz.

### Corrosion Control in Potable Water Systems

Is often misunderstood or so completely involved in theory and equations that it is practically unintelligible to the average water works man. It is, therefore, a pleasure to have an article on the subject, in which temperature, dissolved oxygen, films, silicates, phosphates, inhibitors, and proportional feeding of corrosion control chemicals are discussed simply and lucidly but without the loss of fundamental concepts. This presentation comes from—

ROLF ELIASSEN, Major,
Corps of Engineers, Ft. Douglas, Utah.

### Cleaning Mains and Wells With Compressed Air

Is the story of a novel use of an air compressor for removing sand from wells and the air-shooting of a supply main to remove encrustation and increase its capacity. This simple labor and time-saving scheme is as interesting as it is economical and effective. The author and developer of this scheme is

ROSCOE R. HOWARD, Supt.
Municipal Utilities, Slater, Mo.

### Lubricated Plug Valves vs. Gate Valves in Sewage Works

Is one man's opinion of when each of these types of valves should be used, and the problems each presents in a sewage works. That "one man" with considerable experience is

E. A. LOCKE, Ass't Engr. in Chg.,
Sewage Treatment Works, Hartford, Conn.


VOL. 92, NO. 4


## CONTENTS


APRIL, 1945



**Cathodic Protection Overcomes Operating Difficulties in Mechanical Sewage Filters** ..... 109
By Albert B. Kozma, Supt.
Joint Meeting Sewage Treatment Plant
Rutherford, New Jersey

**Water and Sewage Patents** ..... 114

**Canadian Section's Silver Anniversary Meeting** ..... 115

**Locating Water Leaks the Modern Way** ..... 121
By Alan D. Drake, Director
Division of Water, Buffalo, N. Y.

**The Porous Plate Filter Underdrain System** ..... 123
By Frank C. Roe, The Carborundum Co.
Perth Amboy, New Jersey

**The Place of Public Works in Planned Post-War Construction** 127
By Col. Willard F. Rockwell
President, Pittsburgh-Equitable Meter Co.
Pittsburgh, Pa.

**Improved Residual Chlorine Test** ..... 131
By F. W. Gilcreas,
Division of Laboratories and Research
New York State Dept. of Health, Albany, N. Y.

**Corrosion of Iron by Sulfides** ..... 133
By Richard Pomeroy, Ph.D.
Montgomery and Pomeroy, Eng'rs & Chemists
Pasadena, California

**A Lubrication Check Sheet** ..... 139
By Robert C. Urban, Sanitary Engineer
Corps of Engineers, War Dept.

**Sludge Bulking Controlled by Chlorination** ..... 141
By Stephen R. Kin, Sanitary Eng'r
Camp Butner, North Carolina

**Editorial** ..... 142

**Meetings Scheduled** ..... Ad. Page 73

**Here and There with "Doc" Symons** ..... 74

**Manufacturers' and Equipment News** ..... Ad. Page 82

**Literature and Catalogs Received** ..... 91



H. P. GILLETTE, Pres.; E. S. GILLETTE, Vice Pres. and Publisher; L. H. ENSLOW, Vice Pres. and Editor; J. C. BLACK, Mgn. Editor; GEORGE E. SYMONS, Associate Editor; Editorial Associates—J. R. BAYLIS, A. M. RAWN, H. A. FABER; H. J. CONWAY, Adv. Editor; L. D. SANDERS, Make-Up Editor. *Chicago Office*, E. H. Hickey, Rep., 330 S. Wells Street; *Cleveland Office*, Lee B. McMahon, Mgr., Leader Bldg.; *New York Office*, J. M. Angell, Jr., Mgr., 155 East 44th Street; *Los Angeles Office*, Don Harway, Rep., 816 W. Fifth Street.



WATER WORKS & SEWERAGE is a monthly publication. Single Copies, 25 Cents; Subscription Rates U. S. and Canada, $2.00 per year; Foreign, $3.00 per year.

BLUE
PRINT
NOW!
AWWA
NEWWA
FSWA
WSWMA
Committee on Water and Sewage Works
CITY OF SYLVAN GROVE
S. M. Lawson, Mayor
G. C. Calens, Clerk
J. F. Meinhertz, Sup't.
Neptune Meter Company
2107 Grand Avenue
Kansas City, Mo.
Gentlemen:
It is with pleasure and pardonable pride that I am writing to advise you that I have just signed the 27th meter contract with the Neptune Meter Company, representing 27 years of service with the City of Sylvan Grove; an enterprising agricultural community, which has furnished the surrounding towns in Kansas with an agricultural fair and livestock exposition for 35 years of continous success.
The experience shown and satisfaction given me in using Trident Meters has led me to feel that I would highly recommend them from a standpoint of accuracy,
find complete Victory
continue to serve the City
with meters of the highest qu
We are all being forced to make certain sacrifices and endure inconveniences particularly in the waterworks field.
But my use of Trident Meters, with their famous "Interchangeability" and ease of repair has made my job considerably easier.
Yours very truly,
J. F. Meinhertz
Sup't. Municipal Waterworks

**WO WARS have taught the value of Trident Water Meters — "their economy, durability, quality and low maintenance cost," to quote this steady buyer of Tridents for over a quarter-century. So blueprint your future water meter buying wisely.**

***Investigate Trident Water Meters. Your nearest Trident representative will be glad to give you any facts you may require.***

119

**NEPTUNE METER COMPANY • 50 West 50th Street • New York 20, N. Y.**

**Branch Offices in CHICAGO, SAN FRANCISCO, LOS ANGELES, PORTLAND, ORE., DENVER, DALLAS, KANSAS CITY, LOUISVILLE, ATLANTA, BOSTON**

**Neptune Meters, Ltd., Long Branch, Ont., Canada**

WATER WORKS & SEWERAGE

VOL. 92, No. 4 A Gillette Publication APRIL, 1945

# CATHODIC PROTECTION OVERCOMES OPERATING DIFFICULTIES IN MECHANICAL SEWAGE FILTERS

By ALBERT B. KOZMA
Superintendent
Joint Meeting Sewage Treatment Plant
RUTHERFORD, N. J.

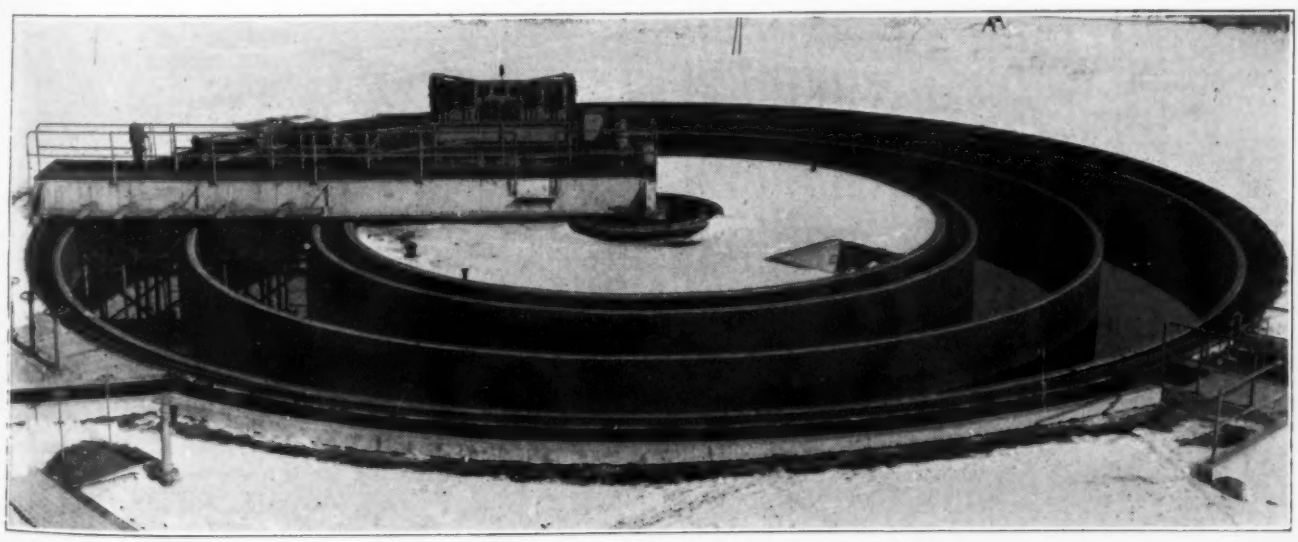
MECHANICALLY cleaned sand filters for treating sewage became quite popular during the last decade due to their ability to produce uniform, "polished," effluent. While they temporarily fell into disrepute due to operating difficulties they are bound to stage a comeback if the causes of these troubles can be eliminated.

Much has been written on sewage sand filters by Zack in the *Sewage Works Journal*[1] and a series of up-to-date articles were published by Streander in *Water Works and Sewerage*.[2]

These filters first followed the pattern of the old, backwash type water filters both in this country and abroad. The first modern type filter, the magnetite filter, was installed at Dearborn, Mich., in 1932. Many similar installations followed. The first silica sand filter with a hydraulic type of automatic washer was built by the Underpinning and Foundation Co., Inc., at South River, N. J., in 1937.

Both these modern filters have several features in common: a comparatively thin layer of sand (2 in. to 6 in. deep) is supported by copper or bronze screens which rest on steel gratings. A mechanical cleaner travels over the sand bed at certain intervals when the hydraulic head through the filter exceeds a certain limit. Some units are combined with circular settling tanks, located on their peripheries, others are self-contained, annular shaped or rectangular.

W. G. Laughlin of New York, inventor of the first magnetite filter, was the first to realize the disadvantage of using copper and steel submerged in sewage and developed the "Simplex" filter where the sand support consists



**The Effluent Filter of Rutherford, N. J.—Capacity 4 M.G.D.**
*(Consists of Two Annular Mechanically Washed Sand Beds, the Underdrainage System of Which Is Now Cathodically Protected.)*

of broken stone and underdrains. The International Filter Co. recently announced a new filter providing hard rubber screens and steel gratings for supporting the sand, the purpose of this combination being to eliminate galvanic corrosion. The manufactures of the magnetite filters have been experimenting with wooden instead of steel gratings.

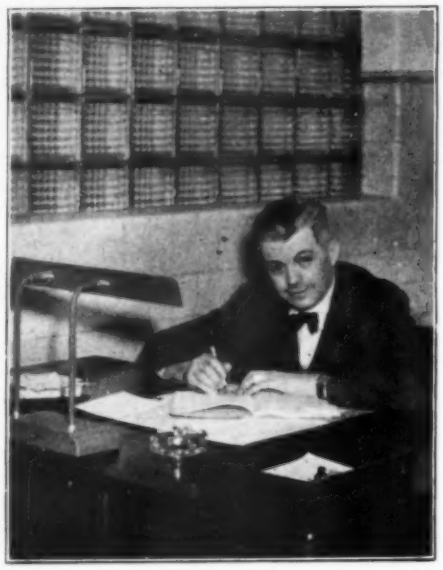
### *Investigation by the A.S.C.E.*

The Second Progress Report of the Sanitary Engineering Division on Sewerage and Sewage Treatment published in the April 1944 issue of the American Society of Civil Engineers, pages 483 and 484, says the following about magnetite filters:

"Effluent filters of crushed magnetite, arranged for cleaning by means of solenoids, have been abandoned at Denver, after six years of effort, to remodel the apparatus. Because of mechanical difficulties uninterrupted operation could not be secured for even 30 days. The principal troubles were: difficulty in insulating the solenoid windings so that the underwater service could be maintained, difficulty in maintaining a filter bed of uniform thickness, CORROSION OF FILTER SCREEN AND ITS SUPPORTS, and a loss of filter material. During the six years the actual efficiency of the filters could not be determined because of short periods of operation. The power usage was excessive. The removal of solids was relatively expensive.

"At Cleveland, in the Southerly Plant, Ellms also reports a high cost of operation and upkeep, WITH DIFFICULTIES SIMILAR TO THOSE AT DENVER, except for the insulation of solenoid windings. Little benefit was indicated in filtering the trickling filter effluent.

"At Minneapolis-St. Paul, the effluent filters were in service for only a few days each year from July 6, 1938 (for example, 39 days in 1942). The erosion and displacement of the magnetite sand on the beds proved a major difficulty. THE STEEL GRATINGS SUPPORTING THE SAND CORRODED AS AT DENVER."



**The Author**
*(In his swanky office)*

The remarks pertaining to corrosion (stated in capitals by the author for emphasis) are equally applicable to silica sand filters.

### *The Installation at Rutherford, N. J.*

The Underpinning and Foundation Co., Inc., installed a silica sand filter at Rutherford, N. J., in 1940. The filter has two annular or circumferential shaped beds arranged concentrically, with a total effective area of 2780 sq. ft. and it is rated at one and one-half gallons per sq. ft. per min. for a peak flow of 6 million gallons per day rate. (See cover picture.) The actual flow to date has not exceeded 2.4 mgd. and either one of the two filter beds will handle the normal flow rates. This arrangement provides for a standby in case either one of the units has to be taken out of operation. The filter is preceded by chemical and biological treatments, the latter provided by four standard trickling filters and two secondary settling tanks, the settling tanks being designed for two hours detention.

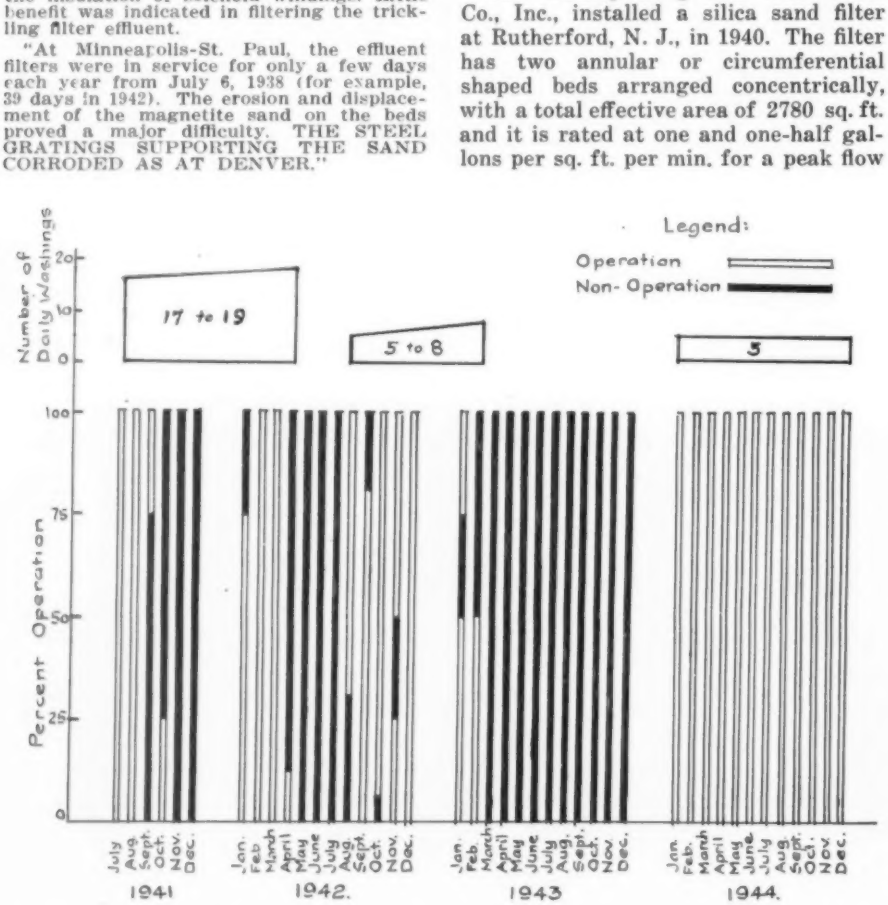
Operation started on July 1, 1941, and continued that month and through August, with an average of 17 normal mechanical cleanings of the sand beds per day. In September the equipment had to be shut down for three weeks for manual cleaning of the screens, and again for three weeks in October. In November and December the filter was not operated due to mechanical difficulties. Operation was resumed in January 1942, and only one week was lost to permit manual cleaning during this month. From February 1 we were able to operate continuously until April 4, the number of daily normal washes ranging between 18 and 19.

Summarizing the above period of operations from July 1, 1941, to April 4, 1942, the filter was running only 52 per cent of the total time. Following this period the equipment had to be shut down, all the sand removed, the copper screens and steel gratings taken out and trucked to the contractor's shop and cleaned with a power operated rotary steel brush. The gratings were left unpainted.

Operations were resumed on August 9, 1942, and continued until September 26, when the filter was bypassed for one week to permit manual cleaning. It was operated again between October 3 and November 7, November 14 and January 16, 1943, January 23 and February 13 respectively, when it had to be shut down for the rest of 1943 to avoid repeated manual cleanings necessary to keep it in operation. During this whole period, from August 9, 1942 to February 13, 1943 the filter was operated 75 per cent of the total time and the daily normal washings averaged 5 to 8.

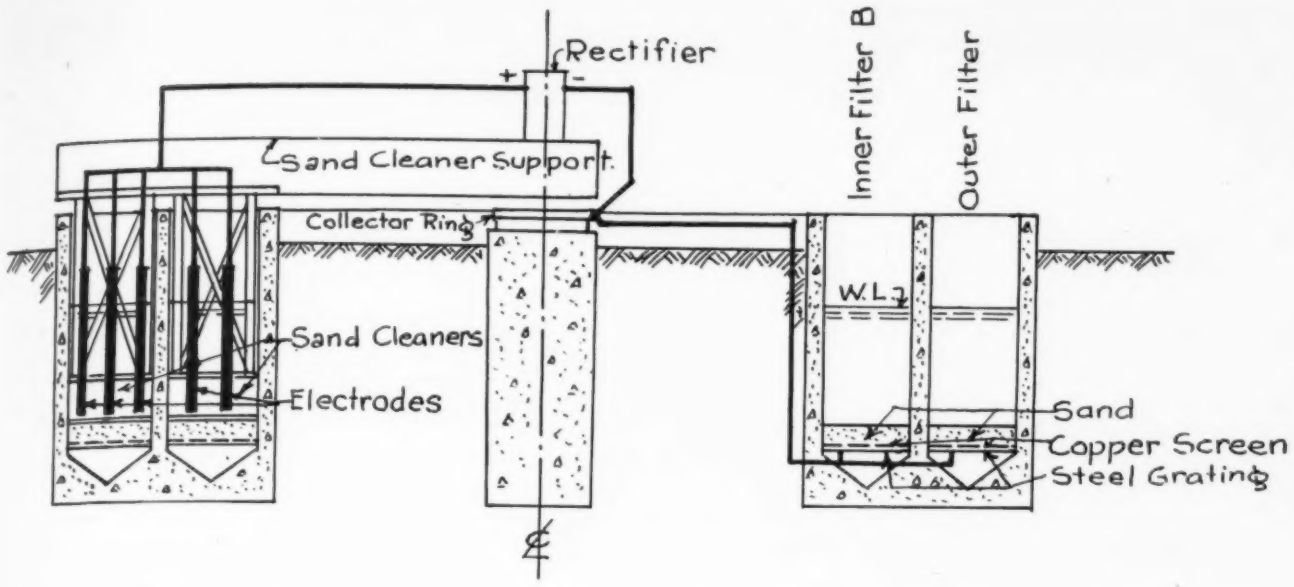
This time we decided to use chemicals for cleaning the copper screens and steel gratings. After removing them from the filter bed we bathed them in hydrochloric acid diluted with water in 1:2 proportion, using aniline oil as inhibitor, to clean off rust and scales. This was followed by a zinc sulphate rinse and clean water bath for neutralization. All the steel gratings were painted with various types of tar and asphalt base paints with the exception of three sections which were left unpainted to serve as control sections for test purposes.

In addition to painting, cathodic protection was provided and operation resumed on January 1, 1944. Since then operation has been uninterrupted and the daily normal washings have been reduced to five.




**Operating and Non-operating Periods of Sand Filter and Record of Washing Frequency**

*(Cathodic protection was placed in operation Jan. 1, 1944. The filter has remained in continuous operation since and washings reduced to five daily—a record which speaks for itself.)*




*(Note connection to rectifier from the steel support gratings for the copper-screen, on which rests the downflow sand bed. The five partially submerged graphite electrodes suspended from the sand cleansing unit travel around the filter with the revolving carriage, whose operation is intermittent and manually controlled.*

*Since current for cathodic protection has been insignificant in amount the process is left on continuously. However when the cleaning mechanism is converted to automatic intermittent operation, some current saving may be realized by arranging automatic cutout of the rectifier when the cleaning mechanism is standing idle.)*

### *Theory of Corrosion and Cathodic Protection*

Before installing cathodic protection the principal cause of our operating troubles was corrosion of the steel gratings, the product of the corrosion depositing and plugging the slots in the copper screens.

Galvanic corrosion is a well known phenomenon which occurs when two different metals are submerged in an electrolyte to form an electrochemical couple. In our case the copper screens and steel gratings are the two dissimilar metals, and these with the sewage as an electrolyte form a galvanic cell or battery. An electric current is generated between the two metals, this current transporting metallic and other ions from the steel and sewage to the copper screens. This, in our case, resulted in a hard, impervious deposit on the screens made up of ferrous and ferric carbonates and oxides and served to quite thoroughly seal up the minute openings in the copper screens. The formation of such a deposit results from the alkaline conditions surrounding the cathode in such a cell—in this instance the copper screens.

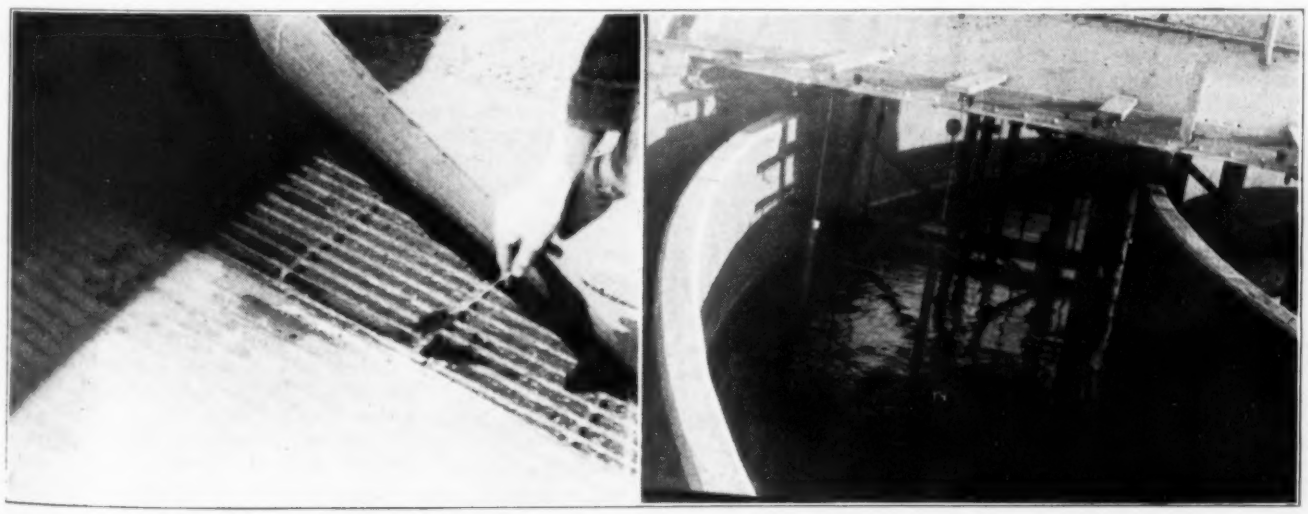
In general it will depend upon the relative position of the two metals in the electrochemical series, shown in the following table, as to which metal will pass into solution.

**Electrochemical Series**

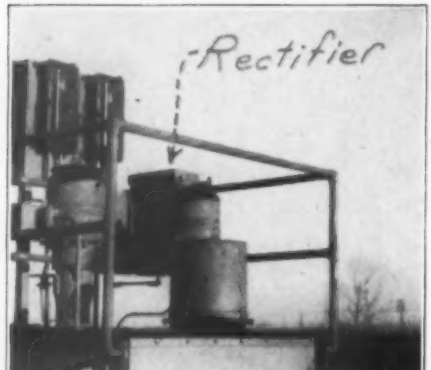
| Metal | Potential Volts |
|---|---|
| Calcium | +2.70 |
| Aluminum | +1.28 |
| Zinc | +0.76 |
| Iron | +0.43 |
| Lead | +0.12 |
| Tin | +0.01 |
| Hydrogen | 0.00 |
| Copper | —0.34 |
| Gold | —1.30 |

Note—This tabulation is only a partial list.

The metal with the higher potential is the anode, and that with the lower is the cathode. The dissolved positive, anodic ions tend to move from the anode to the cathode and, if conditions are right, they may be deposited on the latter. The intensity of the electrochemical action and, as a result, the



**Left—Screen and Grating Inspection. Right—Bed Cleansing Carriage Showing Suspended Arches**
*(Note absence to choking deposits, but a thin protective deposition of ferric hydroxide principally and no copper. Beneath this coating the metal was clean and bright.)*




**Location of the Weather Proof Rectifier**

rate of corrosion depends upon the difference of the potentials and upon the circuit resistance. The higher the current flow is, the higher is the rate of corrosion. It is always the anode in a galvanic cell that is corroded.

On the other hand, if the negative or cathodic metal is such a galvanic cell (the copper screen in our case) can be neutralized by some artificial means, corrosion of the anodic metal will cease. The direct cause of the corrosion of the anodic (steel) grating is the current flowing from the grating to the copper screen, this current flow being due, as explained, to the difference in the potential of the two metals. This current flow can be neutralized or stopped by installing electric conductors (electrodes) in the form of rods in the sewage and imposing upon them a direct current from an outside source of such voltage and amperage that there will be flow of current from the installed conductors (anodes) to the steel grating. This stops the flow of current from steel to copper, and when done, the steel is no longer anodic but cathodic, therefore no longer suffers loss of metal or corrosion. In brief, the naturally anodic metal has artificially been made cathodic, and in the process it gains protection from further corrosion; hence the term "cathodic protection."

The new installed electrodes are now the anodes in our large galvanic cell and, if of such composition that metal is lost as the imposed current flows from them to the steel gratings and copper screens, these electrodes are called "sacrificial" anodes. Iron, stainless steel and to some extent graphite are of such nature. Platinum which is also used differs from the others in that it does not deteriorate and is permanent.

### *Cathodic Protection Equipment*

In the search for some means of making the filter operation practical the author investigated the possibility of using cathodic protection. Arrangements were made with a company engaged in supplying the equipment for steel water tanks to make the installation.

The equipment consists of a selenium rectifier unit, rated at 8 amperes, 24 volts. Five graphite electrodes, 2½ in. in diameter, submerged three feet in sewage are installed in front of the cleaners (see illustrations), three in the outer and two in the inner bed so as to revolve with the cleaner. The negative side of the rectifier is connected to the copper screens and steel gratings and the positive side to the electrodes. Approximately 3.9 amperes of current is furnished at 12 volts to protect the screens and gratings for 2,800 sq. ft. of nominal filter area.

In the installation and use of this cathodic protection equipment special precautions had to be taken to get results. For instance, if anodic spots had appeared on the screens and gratings, due to improper bonding of the several sections of the screens, corrosion might have been accelerated instead of arrested. Adjusting the current for proper density was also found very essential.

### *Results of Cathodic Protection*

In observing the effect of cathodic protection the change in the appearance of the gratings was the most significant. The first observations were made four months after commencing operations and a ¼-in. thick, soft, brownish deposit was noted on the unpainted steel gratings. Chemical analysis indicated the absence of carbonates and the presence of iron and manganese hydrates. Copper was entirely absent. The quantity of iron present as Fe. was 52 per cent. The loss on ignition amounted to 20 per cent.

The deposit was soft, easy to wipe off, leaving a thin, black layer near the metal. This layer could be readily brushed off leaving the bright steel surface. Similar conditions were found also on practically all the painted gratings except that they were more irregular depending upon variations in the protective thickness of the paint. The painting apparently provided no effective protection and failed practically 100 per cent in a year. The copper screens were found tarnished but clean, the slots open, with occasional sand grains mechanically wedged in the openings.

The deposit contained much iron which was not a corrosion by-product but a protective precipitate caused by hydrolysis, induced by the current and the natural increase in pH at the surface of the cathodic steel. The presence of the iron in the deposit is readily accounted for by its use as a coagulent in the sewage ahead of the filter.

Before the cathodic protection equipment was installed a gradual increase in the hydraulic head took place through the filter after a few weeks of operation, due to the increasing plugging up of the copper screen openings. Following this installation, however, this head remained within a constant range, variation only taking place before and after washings.

The observations were repeated every four months during 1944 and showed substantially the same conditions, indicating that the soft layer forming on the steel gratings sloughs off after it reaches a certain thickness.

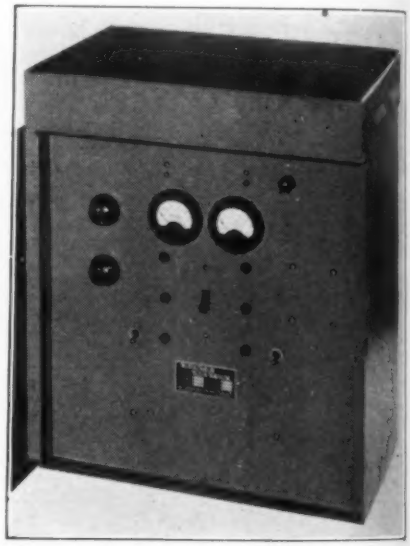
### *Operating Costs*

Our records show that without cathodic protection the screens and gratings had to be removed and cleaned at least every 12 months. In between times other methods of hand cleanings had to be resorted to, resulting in a low percentage of operation. The first complete removal and cleaning in 1942 was done by the contractor; no cost figures are available. The second cleaning in 1943 including painting required $1,000 worth of materials and $600 of labor.

Since cathodic protection was installed over a year ago the filter has been operating without any decrease in efficiency. The electric current, based on a rate of 1.8c, per KWH, cost 4c per day or about $15 per year. The electrodes have lasted a year so far and when it will be necessary to renew them the cost will not exceed $30.

### *Conclusion*

Since installing the cathodic protection equipment we have been operating our mechanically cleaned sand filter for over a year without any interruptions save some minor ones for mechanical repairs, and have lost practically no filtering time. We have made periodical observations during this time on the screens and gratings and noted the performance of the filter.



**The Selenium Rectifier**
(*Rated at 8 amps. and 24 volts.*)

Based on these observations we can draw the following conclusions:

(a) Cathodic protection prevents corrosion of the copper screens and steel gratings.

(b) Prevents the clogging of the copper screens.

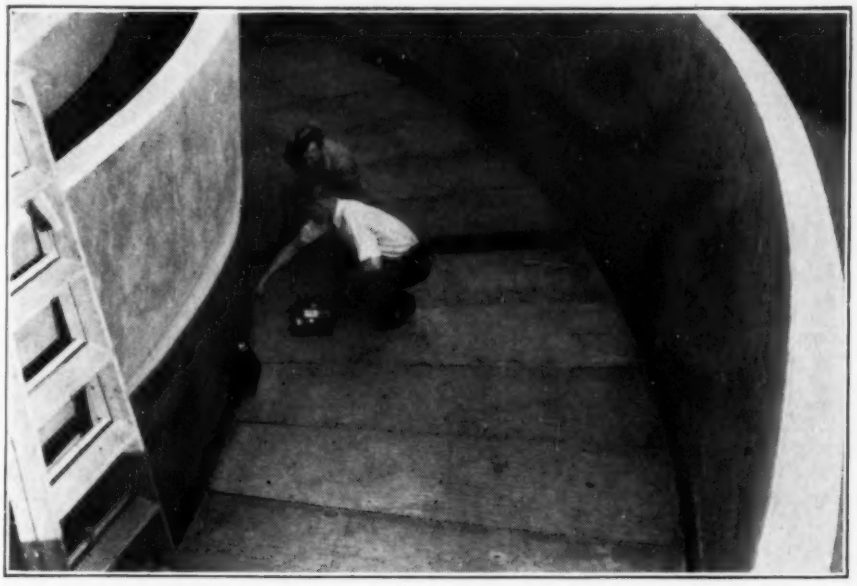
(c) Due to (a) and (b) the equipment can be continuously operated.

(d) Cathodic protection obviates the necessity of costly hand cleanings, consequently it helps to reduce maintenance costs.

We feel that our mechanically cleaned sand filters, after having been equipped with cathodic protection equipment, have fulfilled the original purpose of their installation, namely the production of a uniform, "polished" effluent in an efficient and economical manner. The exorbitant expenses and inconveniences caused by the frequent interruptions in operation have been eliminated.

The cathodic protection equipment used in this work was furnished by and installed under the direction of the Gregg Co. of Philadelphia, who represent the Johnston and Jennings Co. of Cleveland, manufacturers of "Rusta Restor" equipment.

Mr. P. S. Wilson, vice president of the Gregg Co., was of great assistance in the preparation of this article and furnished most of the photographs used to illustrate it.



**P. S. Wilson, Supervising the Installation**

*(Makes a doubly thorough test for effective bonding of the segmental filter gratings to insure against establishing anodic areas and electrolytic corrosion.)*

### References


(1) S. I. Zack.
The Laughlin Process of Sewage Treatment, *Sewage Works Journal*, vol. V., pp. 458, etc.
Magnetite Filters in Sewage Treatment, *Sewage Works Journal*, vol. VIII, pp. 94, etc.
Mechanical Filtration of Effluents, *Sewage Works Journal*, vol. IX, pp. 466, etc.

(2) P. B. Streander.
Sewage Filtration with Silica Sand Filters, *Water Works and Sewerage*, August, September and October, 1940.

(3) American Society of Civil Engineers.
Proceedings, vol. 70, No. 4, Advances in Sewage Treatment and Present Status of Art, Second Progress Report of the Committee of the Sanitary Engineering Division on Sewerage and Sewage Treatment, pp. 483 and 484.

(4) G. W. Gleason.
Fundamentals of Corrosion, *Journal of American Water Works Association*, vol. 33, No. 7, pp. 1249 to 1262.

(5) Gordon L. O'Brien.
Tests on the Cathodic Method of Protecting Steel Water Tanks, *Water Works and Sewerage*, July 1942.


## Geo. Rohan Enters Equipment Field

**Resigns as Supt. of Water at Waco, Texas, to Establish Own Company**

George J. Rohan, for the past twelve years Superintendent of the Waco Water Works, Waco, Texas, has resigned his position and now heads The Rohan Co. of Waco, Texas, distributors of water works and municipal supplies.

**Geo. J. Rohan**

Mr. Rohan has been active in the American Water Works Association for many years, having served as Chairman of the Southwest Section in 1934, and as AWWA. Director from 1939 to 1942. For the past three years he has been Secretary of the Southwest Section.

The Rohan Co. will act as distributor in the Southwest for the Hays Manufacturing Co., Hydraulic Development Corp., Rensselaer Valve Co., and will represent the National Water Main Cleaning Co. and other nationally known water works supply manufacturers.

## Steel Pipe Restricted in 2nd Quarter

**Dir. 4 to Order U-1**

As in the case of steel for sewage plants, a restriction has been placed on steel pipe for water utilities for the second quarter. This restriction was announced in Dir. 4 to Order U-1 on Mar. 28. While the limitation does not apply to any utility which will use less than 10 tons in the quarter, the direction limits the utility to ordering not more than 20 per cent more steel pipe than was used for maintenance, and minor plant additions in 1944. Appeal can be made for exception to this limitation, if necessary.

## NYSSWA Sections to Hold Meetings

In the absence of the regular June meeting of the New York State Sewage Association, cancelled in accordance with the edict of ODT, the several sections of the Association will hold meetings. Section meetings in NYSSWA are not uncommon, for the five sections regularly hold one-day sessions two or three times each year. In this year of limited technical conventions, however, these section meetings take on added significance. Not only do they become more important in their own right, but technical papers originally scheduled for the annual June meeting of the parent association will be divided among the sections for presentation at the local meetings.

To date three section meetings are scheduled, The Western Section at The Town of Tonawanda (Kenmore)—April 28; The Long Island Section, at Tallman's Island Plant, New York City, May 23rd, and the Capitol Section at Albany, June 8. At the latter meeting the Executive Committee of the NYSSWA will hold its regular session. None of these meetings will require railroad transportation or hotel reservations for more than fifty persons and yet each is expected to draw more than that number of members.

# WATER AND SEWAGE PATENTS

(OF RECENT ISSUE)

## WATER PATENTS

**Check Valve.** Henry B. Lee (to Ludlow Valve Mfg. Co., Inc., Troy, N. Y.); U. S. 2,368,149; Jan. 30, 1945; (Appl. 7-9-43).

**Liquid Treating Apparatus and Process.** Walter H. Green (to Infilco, Inc., Chicago, Ill.); U. S. 2,368,354; Jan. 30, 1945 (Appl. 6-13-38). An upflow coagulating and settling tank with agitator in the bottom, mixing chamber, with baffles and settling chamber above.

**Treatment of Water.** Milton J. Shoemaker (to Research Products Corp., Madison, Wis.); U. S. 2,368,574; Jan. 30, 1945 (Appl. 8-21-42). A two tank system of hydrogen exchange material treatment of water to remove alkalinity of water containing alkaline and neutral metal compounds dissolved therein, with provision for regeneration sequence.

**Centrifugal Pump.** Carl Blom (to Byron-Jackson Co., Vernon, Cal.); U. S. 2,368,962; Feb. 6, 1945 (Appl. 6-13-41).

**Water Softener.** Glenn S. Ralston (to Servisoft, Inc., Rockford, Ill.). U. S. 2,370,190; Feb. 27, 1945; (Appl. 8-21-41). A water softener apparatus apparently for home use, depending on an ion-exchange material for softening.

**Liquid Treatment.** Ewald A. Kamp and Frank D. Prager (to Graver Tank and Mfg. Co., Chicago, Ill.). U. S. 2,370,356; Feb. 27, 1945; (Appl. 3-22-43). A combination flocculation and sludge filtration tank with the flocculation space annularly displaced around the sludge filtration tank within, with a multiplicity of port inlets so placed as to cause the water in the flocculation chamber to rotate spirally and a means for removing excess sludge from sludge tank through which the water and floc passes upwards through a sludge blanket.

**Vitreous Compositions Consisting of Oxides of Alkali Metal, Phosphorus, and Other Selected Divalent Metal.** Charles S. King (to Blockson Chem. Co., Joliet, Ill.). U. S. 2,370,472; Feb. 27, 1945; (Appl. 10-7-40). A method of making an alkali metal polyphosphate for use as a water softener.

**Water Treatment.** Charles S. King (to Blockson Chem. Co., Joliet, Ill.). U. S. 2,370,473; Feb. 27, 1945; (Appl. 7-17-41). A method of treating domestic waters for softening by the addition of the water soluble "glass" mentioned in U. S. 2,370,472.

**Rotameter.** Nathaniel Brewer (to Fischer and Porter Co., Hatboro, Pa.). U. S. 2,370,634; Mar. 6, 1945; (Appl. 8-13-43). A rotameter comprising a vertical metering tube having a movable metering float therein.

**Apparatus for Removing Iron Dissolved in Water.** Herbert L. Bowers (to Permutit Co., New York, N. Y.). U. S. 2,370,772; Mar. 6, 1945; (Appl. 7-12-41). A tank system installed on a water main under pressure with a restriction in the main which forces water into first tank wherein a constant amount of air under pressure is maintained for air oxidation of the iron compounds followed by another tank, a pressure filter wherein the precipitated iron is filtered out. An air relief valve maintains a constant water level in the first tank.

**Method and Apparatus for Banding Tanks.** John M. Crom, Washington, D. C. U. S. 2,370,780; Mar. 6, 1945; (Appl. 11-4-42). Method of prestressing concrete tanks.

## SEWAGE PATENTS

**Disposal of Refinery Wastes.** Parker E. Malson (to Shell Development Co., San Francisco, Cal.). U. S. 2,367,172; Jan. 9, 1945; (Appl. 5-25-42). A process for removing alkyl phenols from hydrocarbon oils and simultaneously disposing of waste products.

**Pickling Solution.** Stephen F. Urban, Chicago, Ill. U. S. 2,367,811; Jan. 23, 1945; (Appl. 4-19-41). Electrolytic system for maintaining the composition of pickling liquor substantially constant as to iron and sulfuric acid content.

**Sedimentation Apparatus.** Samuel I. Bousman (to Western Machinery Co., San Francisco, Cal.); U. S. 2,368,703; Feb. 6, 1945 (Appl. 1-29-43). A circular sedimentation basin with central pier and inlet, and peripheral effluent overflow, with rotating scraper blades, powered by centrally located motor and bull gear located beneath walkway truss.

These patent abstracts being brief do not necessarily cover the entire scope of the invention described. If the reader becomes especially interested in any of these patents he should obtain printed copies of the complete patent, at 10 cents each, from the Commissioner of Patents, Washington 25, D. C.

**Sedimentation Apparatus.** William C. Weber (to The Dorr Co., New York, N. Y.); U. S. 2,369,194; Feb. 13, 1945 (Appl. 1-1-43). A circular sedimentation basin with rotating mechanism for collecting sludge and removing it from central bottom. The influent consists of a submerged wall (with flow distributing openings), extending from the outside circular wall at one point to the center column. Sewage flow is circumferentially to the opposite side of this wall where the effluent is drawn off at the surface.

**Disintegrator for Sewage Sludge and for Like Purposes.** William King Porteous, St. Margaret's, Twickenham, England; U. S. 2,369,312; Feb. 13, 1945 (Appl. 7-21-42). A disintegrator for sewage sludge solids consisting of a combination of rotating and stationary blades, with inlet and outlet for sewage solids.

**Sedimentation Apparatus.** Samuel I. Bousman (to Western Machinery Co., San Francisco, Cal.). U. S. 2,370,120; Feb. 27, 1945; (Appl. 1-29-43). A circular sedimentation basin with center inlet pier and peripheral overflow weir, with rotating scrapers to move settled solids to center groove surrounding the pier, and vertically adjustable scrapers to operate in this groove which is connected to sludge draw-off.

**Recovery and Reuse of Copper Sulfate From Wash Liquors.** William H. Furness (to American Rayon Co., Inc., Riverton, N. J.). Recovery of industrial wastes in cuprammonium rayon processes.

**Method of Treating Sewage or Other Waste Material.** Lawrence E. Langdon (to Pacific Flush Tank Co., Chicago, Ill.). U. S. 2,370,794; Mar. 6, 1945; (Appl. 2-26-42). A primary treatment and sedimentation apparatus, providing short aeration at inlet end of rectangular tank followed by a quiescent zone wherein floatable solids float under influence of and aided by rising air bubbles, and wherein settleable solids settle, both to be removed by mechanically operated scraper flights.

**Filter.** Arthur Wright, Upper Montclair, N. J. U. S. 2,371,417; Mar. 13, 1945; (Appl. 12-12-41). A continuous rotary drum filter with a belt compressing the cake formed on the drum; said belt formed of a plurality of parallel cords disposed peripherally over the cake washing and drying zone for movement therewith and means for maintaining the cords under tension and in contact with the drum.

# CANADIAN SECTION'S SILVER ANNIVERSARY MEETING

## Attendance at 25th Annual Meeting Tops All Previous Records by About 300

"*LOOK out California here we come!*" could have well been the slogan for the 25th Annual Meeting of the Canadian Section of AWWA held in Toronto, March 19-21st.

The Canadian Section dates back to 1920 when 32 attended the first meeting held in Montreal. In Toronto last month for the 25th meeting the official registration was exactly 800 and the total attendance probably 100 more.

Relative to the above slogan referring to California, it is interesting that the California Section (AWWA's largest) celebrated its Silver Anniversary last Fall with an attendance of 927. The Canadian Section with its 74 member gain for the past two years is now the third largest AWWA Section with 363 members. With its jump in attendance from 555 in 1944 to 900 or thereabouts this year it is pushing California hard in respect to meeting attendance records. While an impressive attendance was expected at Toronto, what happened passed all anticipation. Those who came were not disappointed, for it was a great "show" any way one evaluated it.

*W. A. Allan*
*Plant Supt.*
*St. Thomas, Ont.*
*(The Hunt Award)*

*C. J. Des Baillets*
*Chief Engr.*
*Montreal, Que.*
*(The Fuller Award)*

The sessions were good and well attended throughout. The entertainment provided by the Canadian Water Works and Sewerage Equipment Association was top-flight quality. And, again the operation of the "Water Works Club Room," for the benefit of all who cared to come in for refreshments and sociability during after-session hours, was a complete success. This innovation in entertainment, introduced three years ago has been successfully substituted for room entertainment, which also means that those attending technical sessions are not lured away to hotel rooms, and the session attendance is thereby exceptionally good. This "experiment" by the Equipment Association has been loudly praised by Section members and the equipment men agree that it has proved to their liking too. It hardly needs saying that for such an undertaking, where free liquid refreshments are lavishly served, to be a success depends upon the management of the enterprise. However, the Canadians seem to know how to keep the affair under control and have done a good job with the running of the Canadian Water Works Club. Like the Canadians, we are enthusiatic about the scheme as an equitable, orderly method of entertaining during off hours when scheduled events are not on. It is a grand place to find people, to meet new folks, to talk shop or anything else that interests you.

Following the Annual Banquet the Equipment Association provided a floor show of high quality throughout and at the end the audience repaired to the "Club Room" to dance through the balance of the evening.

**Chairmen**

*A. L. McPhail*
*Supt.*
*St. Catharines, Ont.*
*(Retiring)*

*W. H. Waddell*
*City Engr.*
*Owens Sound, Ont.*
*(Incoming)*

**New Trustees**

*R. N. Martindale*
*Supt.*
*Sudbury, Ont.*

*N. MacNicol*
*Commissioner*
*Forest Hills, Ont.*

### *Awards and Honors*

The awards were made at the Annual Banquet. President Newkirk of AWWA was on hand to present to Prof. R. W. Angus the Honorary Membership certificate voted him by the AWWA Board in January. Prof. Angus taught Hydraulics in the Univ. of Toronto for 44 years and has served numerous Canadian cities in a consulting capacity.

*Prof. R. W. Angus*
*Toronto Univ.*
*Toronto*
*(Honorary Member)*

*Wm. Storrie*
*Cons. Engr.*
*Toronto*
*(30 Year Member)*

To C. J. Des Baillets of Montreal went the Geo. W. Fuller Memorial Award in recognition of his achievements as Chief Engineer of Montreal's Div. of Water and Electricity.

To Wm. A. Allan, Supt. of Pumping and Water Purification, St. Thomas, Ont., went the Section's Hunt Memorial Award for "Sincerity, reliability and efficiency in duty." [This is a very significant award which is given as a means of recognizing those faithful Water Works employees who generally remain in the background while the bosses receive whatever ribbons are passed out. It recognizes the sort of man who considers that duty comes first and that always dependable employee no matter what or when the circumstance.—Ed.]

### *Two M.Ps. in Attendance*

In attendance for the Silver Anniversary of the Section were two members of Parliament, W. G. Case, former Mayor and now Chairman of the Utilities Commission of Owen Sound, Ont.;

**Secretary and Aide**

*A. E. Berry*
*Chief Engr.*
*Ont. Dept. Health*
*Toronto*

*G. A. H. Burr*
*Asst. Engr.*
*Ont. Dept. Health*
*Toronto*

and, the Minister of Health of Ontario, Dr. R. P. Vivian.

Dr. Vivian, as the principal luncheon speaker on the opening day, praised water works men highly for doing an important job so faithfully and well. He pointed out that it doesn't matter how you take it, AWWA spells the same frontwards or backwards and always comes out on top in his estimation. For that reason he, the Minister, had felt that the Canadian Section of the Association deserved the great amount of time and attention which Dr. Berry had been authorized to give it. Realizing how valuable Dr. Berry had been to his Department, he hoped that his dedication to the job of Secretary of the Section was being fully appreciated.

Toronto's Mayor R. H. Saunders was also a speaker. He had reason to know of the specific value which AWWA had been to Toronto's Water Division, and hoped that other Mayors realized what the Association was doing to aid municipalities and save tax monies.

The luncheon closed with a brief talk by President Newkirk who drew attention to the very finely drawn "Code for Members" developed by Secretary Jordan and recently adopted by the AWWA Board as a pattern for water works men to strive to meet. He also commented on the member gains by the Canadian Section and the high regard held for the Section and its prowess under Dr. Berry's helmsmanship. President Newkirk then pointed to the steady growth of AWWA, with a membership of 5555 at the moment.

### *New Officers*

The following were elected officers for the ensuing year:

*Chairman:* W. H. Waddell, Water Supt.-City Engr., Owen Sound, Ont.

*Trustee:* R. N. Martindale, Supt. of Water, Sudbury, Ont.

*Trustee:* N. MacNicol, Works Commissioner, Forest Hill, Ont.

(Carry over trustees are R. Harrison (Scarborough); H. S. Nicklin (Guelph); H. Kellner (Windsor); F. J. Veale (Hamilton). Canadian Director on the AWWA Board is W. L. McFaul, of Hamilton.)

## TECHNICAL SESSIONS

On the first afternoon three sessions were being held simultaneously in adjacent rooms—

Session A—Distribution Systems for the Smaller Communities.

Session B—Underground Water Supplies.

Session C—Water Treatment and Purification.

### *Distribution Systems for the Smaller Communities*

(Chairman, J. W. Peart, St. Thomas, Ont.)

In this session **"Design of Small Distribution Systems"** was discussed by J. G. Powell, Consulting Engineer, Toronto, who pointed out that fire requirements governed the extent and capacities of the system to the extent that the ratio of minimum facilities for fire needs to actual facilities for water supply service was 6 to 1 in communities of 1,000 pop. and slid off gradually to 2½ to 1 for a 10,000 pop. system. In Canada a 6 in. main is considered the minimum for fire service. Distribution storage providing a 10 hour fire demand should be the minimum. Or a combination of stand-by pumps with ground tank storage and gravity supply storage was the alternate. Mr. Powell advocated only looped pipe systems adequately valved at intersections and standardization in respect to choosing only one make of valve for a given size main to attain simplification in maintenance or repairs.

Concerning fire hydrants, with spacing of not more than 250 ft. in business districts or 500 ft. in residential sections, 500 gpm. flow should be had with but 2½ lbs. pressure loss between main and barrel nozzle.

Mr. Powell on the whole favored copper for service lines and pointed out that designers must now watch for possible hazardous cross-connections and back-syphonage from the customer's premises, and check design for such potential hazards to the system.

**"Operation and Maintenance of the Distribution System"** was discussed by E. E. Oke, Manager-Engr., Pub. Utilities Comm., Cochrane, Ont., who commenting on the great value of records of valve, main, service and shut-off cock locations in maintenance and repair, pointed out that accuracy of such records meant the difference between success and failure. He pointed to the value of maintaining a stock of clamp-on sleeves of each size pipe in the system.

Citing his own experiences in Cochrane, Mr. Oke, referred to the satisfaction of having good draining hydrants and amply deep mains. A well looped gridwork of mains does not make for easy flushing or cleaning which the corrosive iron bearing water makes necessary. Service lines are cleared of iron sludge by operating a high pressure pump at the main, and discharging through a broken connection on the customer's premises. When this fails to clear the service nothing but renewal will solve the difficulty.

### *Guided Discussion*

Then followed a "Guided Discussion on Maintenance" which revealed the service life of galvanized services to be a few years to 25 years. Little experience had been had with genuine wrought iron galvanized. There was quite a variety of opinion concerning electrolytic corrosion due to electrical grounding to water pipes and how serious. To determine the existence of electrolytic corrosion required more than visual observation before blaming current flow for the attack. Only current flow instruments could be relied upon for a trustworthy diagnosis and there was danger of jumping to conclusions.

In main and service line installations in lengths up to 250 ft. the cost for hand labor as against machine trenching would be about equal. Beyond 250 ft. machine trenching is only about 35 per cent of the cost of hand labor where trench bracing is not required.

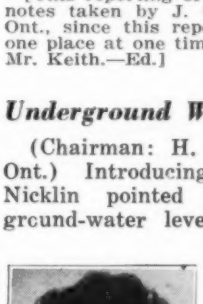
Discussing sand-spun as against centrifugal C.I. pipes it was the opinion that sand-spun pipe was tougher (more like old pit-cast pipe) and required less care in cutting to avoid fracture or cracking.

Installing meters in an upright (horizontal pipe run) position is worth the added cost of so doing.

[This reporting of Session A is based on notes taken by J. Clark Keith, Windsor, Ont., since this reporter could only be in one place at one time. Our appreciation to Mr. Keith.—Ed.]

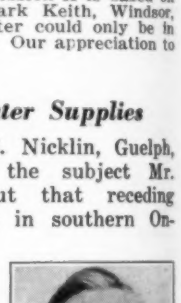
### *Underground Water Supplies*

(Chairman: H. S. Nicklin, Guelph, Ont.) Introducing the subject Mr. Nicklin pointed out that receding ground-water levels in southern Ontario could be charged to the work of man and not to God, inasmuch as precipitation had not been deficient, as some had assumed.



**War Hero**

*Capt. W. S. Waddell*
*Neptune Meters*
*Long Branch, Ont.*
*(Son of Chairman Waddell, wounded during Normandy invasion)*



**33 Yr. Member**

*T. Hodkinson*
*Supt.*
*London, Ont.*
*(Member, AWWA, eight years before Canadian Section formed)*

**"Gravel Walled Wells"** were discussed by T. L. McManamna, President, International Water Supply Ltd., London, Ont., who believes that test wells

**Trustees**

*H. S. Nicklin*
*City Engineer and Supt.*
*Guelph, Ont.*

*H. Kellner*
*Chief Engr.*
*Pumping Stations*
*Windsor, Ont.*

have not been sufficiently used or studied in ground water development planning. Such wells should be let to contract on a footage basis and rotary drilled rather than driven. Only by hard continuous pumping can the specific capacity of any aquifer or expected gravity of water be dependably determined.

Although gravel-pack or gravel-wall tubular wells yield twice to ten times the volume of so-called naturally developed wells in gravel-sand formation, Mr. McManamna stated that 70 gals. (Imperial) should be considered the most economical and safe maximum draft. Rotary drilling was advocated for the large as well as for the test wells. Better alignment is assured and, larger diameters at equal cost. The finer gravel is now pumped into place with better results.

In making a well yield test a 24 hour continuous pump run has proved sufficient. Sterilization of the well was only of temporary effect and not justified. Concerning the resistivity method, recently used in Illinois for estimating well yield, he felt too expensive and no substitute for test wells.

**"Rock Wells"** were discussed by E. F. Roberts, President, E. F. Roberts and Co., Brantford, Ont. He warned against undersized holes and recommended examination of quality of water entering from all levels so that the inferior waters can be cased out. He advocates introduction of rigid governmental control of ground water.

**"Maintenance and Operation of Ground Water Systems"** by V. A. McKillop, Ass't. Gen'l. Mgr. Public Utilities Comm., London, Ont.

Mr. McKillop stated that only about 20 per cent of the precipitation reaches the ground water level in Ontario. In consequence 2.5 sq. mi. of water shed are required to safely yield 500,000 gals. per day. He advocates back-washing of the screen area to increase well inflow. High pressure pumps are used to increase the effectiveness of backwashing. Hydrochloric Acid gives the best results in treating wells for encrustation on screens or in the gravel behind the screens. Compressed air in conjunction with acid treatment is very helpful for dislodging encrustations loosened up by the acid.

Concerning pumps, after 7 years of operation deep well pumps should be withdrawn for examination. If the water contains iron an earlier withdrawal may be necessary, especially if any air enters the pump to increase iron precipitation. A 75 ft. derrick of 2 in. tubular steel is employed in London, requiring about 4 hours to set up for pump withdrawal.

Mr. McKillop stressed the desirability of knowing the output of the well, the water elevations within the well and in the ground. London's water is 250 to 400 ppm. hard and is derived from four groups of wells which makes it difficult and expensive to install and maintain softening. The temperature varies from 45 to 55 deg. F. but a P.U.C. ruling prohibits use of city water for air conditioning.

In pump maintenance Mr. McKillop favors oil over water lubrication.

In the discussion period W. W. Brush, Editor, *Water Works Engineering* told of New York experience in ground water depletion on the west end of Long Island. He advocated that special studies by the Canadian Section looking to the developing ground water control through regulatory legislative acts.

**Hosts**

*R. C. Harris*
*Commissioner of Works*
*Toronto*

*N. J. Howard*
*Supt.*
*Water Purification*
*Toronto*

## *Water Purification*

(Chairman, W. B. Redfern, Toronto)

### *Filter Sand Washing Practice*

The discussion of "Filter Washing Practice" was opened by **J. C. Street**, Supt. of Water, Welland, Ont., who said that it was best practice to wash filters before the full loss of head is reached. Curtailing wash water was false economy. To loosen the sand and slime on dirty sand at Welland they had used both caustic soda and "H. T. H." (high test hypochlorite). The scheme involved drawing down the water to 1 ft. above the sand surface, dissolving therein caustic at rate of 2 lbs. to the sq. ft. of bed area, then lowering the solution into the bed. After standing overnight the filter is washed heavily. The same procedure had been used with "H. T. H." at the rate of 4 lbs. to each 100 sq. ft. and allowing 12 to 24 hour contact before washing.

**Session Chairmen**

*J. W. Peart*
*Gen'l Mgr.*
*Utilities Comm.*
*St. Thomas, Ont.*

*E. V. Buchanan*
*Gen'l Manager*
*Utilities Comm.*
*London, Ont.*

Mr. Street stated that one filter had been equipped with the Palmer Agitator. The results had been excellent and all that the manufacturer claimed for it; had reduced wash water consumption and they expected to equip the entire plant with these revolving bed agitators which really scour the sand.

**A. H. R. Thomas**, Manager, Public Util. Comm., New Toronto, Ont., the second discussor, related the highly satisfactory experience with "Anthrafilt," which had replaced sand in 18 pressure type filters. Before replacing all sand, "Anthrafilt" was tried in two units and found to produce as satisfactory effluent as the sand beds, which had required a 15 min. wash to cleanse the bed, whereas only 5 min. is required for the "Anthrafilt" beds. It had been costing $300 per filter per year to maintain sand beds in good condition. The annual cost for "Anthrafilt" had been about one-tenth of that to replenish the 5 per cent annual loss of "Anthrafilt" due to washing out of fines. After 7 years' experience with "Anthrafilt," Mr. Thomas stated that more water can be put through the filters, less wash water is required, and maintenance cost is considerably less.

### *Guided Discussion*

In the ensuing discussion period O. H. Scott, Manager, Belleville, Ont., was convinced that the combination of Palmer Bed Agitators and "Anthrafilt" was the best bet yet in filtration practice. Wm. A. Allan, Plant Sup't. at St. Thomas, advocated filter washing on a period of service schedule and always before filter choking is revealed by full head loss before washing. And E. J. Buckley, of Hamilton, questioned whether filter beds can ever really be cleaned with water wash alone and nothing to scour the grains.

Discussing filter underdrain systems, J. Clark Keith had found laterals and orifices satisfactory during 20 years at Windsor, and W. A. Allan, after experimentation at St. Thomas, had concluded laterals and orifices the most satisfactory, although the trial of the porous plate bottom or the false bottom with ceramic balls (Wheeler Bottom) had not been included because the study was made some years ago.

### *Chlorination and Taste Control*

**Norman J. Howard,** Sup't of Water Purification, Toronto, a pioneer in super-chlorination for taste destruction, reviewed the history of taste control by various chlorination procedures.

The chlorination process had been successful in taste prevention primarily where algae is responsible. Superchlorimination is the more positive because it actually destroys rather than prevents tastes, and is effective for chemical as well as algae or decayed vegetation tastes and odors. Where superchlorination had failed it was primarily due to temerity and insufficient chlorine dosages. Where the chlorine is applied to raw waters, in many instances an appreciable reduction in coagulant requirement is experienced, as at Toronto, where $18,000 per year was the saving.

Mr. Howard closed with brief comments on the newest chlorination process in which oxidation is secured with chlorine-dioxide, the latter being produced when a solution of Sodium Chlorite is merged with the discharge solution from a chlorinator. Mr. Howard said that the process had been highly effective on the Niagara River and now being used in about 8 plants. (The process is fully described in an article beginning on page 423 of the December, 1944, issue of *Water Works & Sewerage.*)

**Ralph Bates,** Distr. Engr., N. Y. State Dep't of Health, Buffalo, reported that as the result of the effective results with the Chlorine Dioxide treatment at Niagara Falls, all plants on the Niagara River had adopted it with universal satisfaction. The simplicity of the process made it particularly interesting and also the fact that no harm comes from an overdosage of chlorite. No involved equipment is required, the chlorite solution being fed through a hypochlorinator and the dosage is set at one rate and requires no changing thereafter, as contrasted with most other taste control processes. The dosage is 0.5 to 0.6 ppm. of Sodium Chlorite, expressed in terms of available chlorine equivalent, and takes care of varying chlorine dosages. Although the chlorite is selling at 75 cts. per pound, the combination of chlorine and chlorite is not prohibitively expensive and is especially attractive for the smaller plants when expert supervision may be lacking.

**H. P. Stockwell,** Ass't. Water Engineer, Ottawa, Canada, reporting Ottawa experiences, had found prechlorination unsuitable for the highly colored Ottawa River water because of the high chlorine demand and but slight coagulant saving. In warm weather coagulating basins require cleaning at 3-week intervals, and carbon is used to check sludge decomposition in the basins. Filter beds are sterilized once each year by employing a hypochlorite solution used in filter washing. Normally chlorine is added only to the filtered water in dosages to produce 0.05 to 0.15 residual. Mr. Stockwell emphasized the fact that basin cleanings and clean filters had proved of paramount importance in taste control at Ottawa.

### *Operation and Maintenance of Pumps*

In one of the Guided Discussions devoted to pumping equipment, its maintenance and operation, Prof. R. W. Angus served as chairman and "guider" of the discussion.

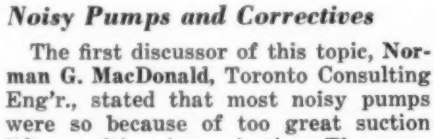
**Equipment Ass'n Officers**

*Geo. Morgan*
*Victaulic Co. of Canada*
*Toronto*
*(President)*

*Jas. B. Kinney*
*Wallace & Tiernan, Ltd., of Canada*
*Toronto*
*(Secretary)*

### *Noisy Pumps and Correctives*

The first discussor of this topic, **Norman G. MacDonald,** Toronto Consulting Eng'r., stated that most noisy pumps were so because of too great suction lift, resulting in cavitation. The maximum lift should not exceed 15 ft. except in special design situations wherein specific speeds must be reduced. As to velocity through suction lines, 7 ft. per sec. should be considered maximum and 5 ft. preferable.



**From Quebec**

*E. A. De Lisle, City Engineer, Shawinigan Falls, Que.*

*Theo. Lanctot, Supt. of Water, Hull, Que.*

*Paul E. Dufrense, City Engineer, Trois-Rivieries, Que.*

**H. G. Hunter,** Montreal Consulting Eng'r., pointed out that motor noise is sometimes mistaken for pump noise. To correct motor noise, the air gap in the motor may be changed.

Professor Angus surprised many listeners by saying that cavitation noise is frequently thought to be due to air bubbles traveling through the pump. As a matter of fact, cavitation is an *absence* of air and due to partial vacuum in the casing. Frequently the admission of minor quantities of air stops the noise. However, as little as 4 per cent air admitted will reduce pump output as much as 40 per cent.

### *What Affects Pump Output Most?*

On this question it was generally agreed that seal and wearing rings were the points to watch and that frequent inspections and checkups should be made to avoid complete shutdowns. On small pumps, foot-valves and strainers had been the worst offenders. The use of vacuum pumps for priming suction lines and pumps was far preferable to foot valves.

### *Surge Troubles*

**H. Kellner,** Chief Eng'r., Pumping Stations, Windsor, Ont., favored the cone valve to the so-called needle valve for surge prevention, because of their more gradual closure.

**W. W. Brush** pointed out that no automatic valve can be guaranteed to correct surge completely, but automatic relief valves can. He spoke from experience with needle valves on the New York system, where relief valves were eventually to be added to the automatic needle type valves.

**C. J. Des Baillets,** Chief Eng'r., Montreal Water Div., employs Larner-Johnson automatic valves on the high service pumps. However, he thought that the network of pressure mains served as a sort of sponge to absorb surges, an important consideration.

**R. Harrison,** Pub. Util. Mgr., Scarborough, has 8-in. cone valves which have been "tuned" with difficulty. He had observed no damage to motors run backwards by surge, this being contrary to popular conception.

**Prof. Angus** pointed out that surge was more of a problem in short lines than long ones, because of the return of the surge wave so quickly from the far end of the short line.

Discussing pump station design, **Wm. S. Lea,** Montreal Consulting Eng'r., pointed to the value of a pump station basement, with location of discharge lines beneath the floor for appearance sake and taking care of pipe sweating problems simply.

### *Tenderings for Water Works Equipment*

(With Particular Reference to the Sales Engineer)

This discussion, guided by Wm. Storrie, Consulting Eng'r. of Toronto, was designed with the idea of hearing the voices of salesmen and sales engineers. However, there was not the expected amount of discussion from this quarter.

"Unbalanced" bids by contractors were frowned upon, and the general opinion was that failure to post guarantee bond could not be justified. It was considered preferable to sell materials and equipment direct to the municipality rather than to the construction contractor. Thus chiselling

*Geo. E. Maxwell* Supt. Water Simcoe, Ont. | *D. M. Hanna* Supt. Distrib. Windsor, Ont.. | *H. L. Pringle* City Engr. Whitby, Ont. | *D. C. Taylor* Office Mgr. Windsor, Ont. | *Wm. S. Lea* Cons. Engr. Montreal

and the like could be avoided and the municipality could make decisions as to what equipment to install.

Unless contracts carry a bonus clause for completion ahead of schedule, a penalty clause is not legal.

The Sales Engineer group pointed out that contractors play equipment companies against each other in price and results in cutting price and deletions. The contractor makes and the municipality loses thereby.

For "extras," cost plus 5 per cent is too little. The matter of "unbalanced" bids is largely in the designing engineer's hands. Sloppy or "tough" engineers usually cause contractors to boost bids 5 per cent to compensate for anticipated grief or bickering.

### *Water Works Administration*

One complete session was devoted to a discussion of water works administration through Public Utilities Commissions as against Council administration. Participants were R. W. Strike, Member, Ontario Hydro-Electric Power Commission; W. G. Case, Member of Parliament, and Chairman of Public Utilities Commission, Owen Sound, Ont.; F. G. Gardiner (K.C.), Mayor, Forest Hill Village, Ont.; Alex. Bissett, Councilman, Etobicoke, Ont.

Mr. Strike, former Public Utilities Commissioner for his home town, made out a splendid case for commission management of water works but warned commissioners and managers against permitting sizeable surpluses to be built up with any idea that it represented good management. On the contrary, some provision should be made for those surplus earnings, beyond a supportable amount to be held in the utilities' name, to go back to the benefit of the community.

[Ed. Note: In Ontario there is a feeling on the part of Public Utility Commissions that the Councils should not be permitted to demand the turning over for administration uses any part of the water works surplus earnings which the revised 1944 law and regulations permits. However, we understand that the surplus can only be used to retire water works debt as long as there are outstanding bonds or notes. After debt retirement any further surplus, however, is usable for general tax reduction. As long as the Commission can show justifiable need for holding or spending the surplus, the Municipal Administration cannot demand any of the surplus so earmarked. To us the law sounds reasonable but has apparently permitted surplus grabbing in some instances when rate reductions seemed the proper solution.]

**F. G. Gardiner,** for Councils, made a splendid case provided the surplus captured is put to proper use. One such use is for improving and maintaining sewage disposal facilities. To Mayor Gardiner's thinking, joint operation of the water and sewage utility seemed eminently proper and sound. It would permit payment of more commensurate salaries to utility managers for one thing. Nowadays more jobs are to be the future trend, which means more retirements and the need for pensions which may properly be financed from utility surplus.

[Having listened intently to Mayor Gardiner, we should say that if all Mayors were Gardiners we don't believe there would be any differences between the Utility Commissions and the Municipal Administrations.—Ed.]

**Hon. W. G. Case,** former president of the Mayors' Assn. of Ontario, and recently elected to Parliament from Owens Sound, made a rip-snorting speech but said little of consequence other than his praise for the invaluable services of President Waddell of the Section, who is City Eng'r. and Sup't. of Water at Owens Sound. He supported Gardiner's arguments straight through, lamenting the fact that complexion of Councils change so frequently.

**Mr. Bissett,** of the Etobicoke Council, was patently a lawyer. He used up his allotted time in saying that Council judgment was broader and better than that of Utility Commissions with narrower vision. In arguing that sizeable surpluses have no place in public enterprise of any nature, he was on safe ground.

### *Question Box*

Under chairmanship of E. V. Buchanan, Manager of the London, Ont., Public Utility Commission, with a panel consisting of W. L. McFaul, Geo. Morgan, J. C. Keith and O. H. Scott, questions from the "Question Box" were put to the panel of experts.

Space does not permit covering all of the questions and answers, but a few of those of most general interest were the following:

Damages from broken hydrants can only be collected if negligence by the water utility can be proven. Failure to shut off the water in reasonable time is considered **negligence.**

Allocation of system costs for domestic vs. fire service varies with the size of community—starting at about 85 per cent of the total chargeable to fire protection in the smallest communities to perhaps 5 per cent for the largest.

An Ontario law permits main extensions, the cost of which is a lien against the properties served. Income from extensions must yield 10 per cent on the investment.

Waters of 1200 ppm. hardness can be softened but will not be economically feasible.

Perth, Ont., seemed to have the longest experience with cathodic tank protection, which has been satisfactory since 1939. During winter corrosion is so suppressed that the system is closed down and the electrodes stored until spring to avoid ice damage.

**The Session on Water Works Administration**

*(Photo, courtesy Eng. & Contract Record)*

**Panel of Experts for Question Box**

*(1) W. L. McFaul, City Engr., Hamilton; (2) E. V. Buchanan, Gen. Mgr., P. U. C., London; (3) J. Clark Keith, Gen. Mgr., P. U. C., Windsor; (4) O. H. Scott, Gen. Mgr., P. U. C., Belleville; (5) George Morgan, Sales Mgr., Victaulic Co. of Canada, Toronto.*

### *Service Line Materials and Installation*

This was the subject of another Discussion Period over which R. Harrison, P.U.C. Manager, Scarborough, Ont., presided.

The general opinion was that all would welcome the return of the day when copper tubing can again be used for service lines. Little experience had been had with the lead alloy tubing "Cameloy," or with cement lined steel or wrought iron. It was developed that copper in cinder fill had a very limited life, and that red-brass pipe (80 per cent copper, 20 per cent zinc) withstood the dissolving action of so-called peaty or humified waters better than did pure copper tubing—as queer as that might sound.

In recounting service installation practice T. Hodkinson, Sup't at London, ing 1 in. services was to use a 1 in. corporation cock with bolted flange connection to copper or lead service line. For 1½ in. and 2 in. services 1¼x1½ in. and 1½x2 in. corporation cocks are employed on mains down to 6 in. size. A 2 in. service from a 4 in. main requires cutting in a 4 in. x 2 in. tee. On 2 and 2½ in. service lines genuine wrought iron pipe is used with Victaulic couplings. However, he emphasized the difference between so-called wrought iron which had lasted only 4 years and the genuine galvanized wrought iron which was good for at least 25 years in London.

It was generally agreed that services should not be installed to vacant lots ahead of the time when needed. A ¾ in. service was considered ample for homes.

Concerning electrical thawing practices the following: With 200 to 300 amps., thawing time for house services is about 10 min. Warning was given to disconnect the house piping system and the ground wire from the house wiring system. In Ottawa H. P. Stockwell reports that their rule is to start thawing at low rate while checking for possible current flow into the house. Only electricians are permitted to remove ground connections or to replace them. If operators of thawing machine are in doubt they *must* call the electrician for advice. At 25 volts 300 to 400 amps. is used for house services and 800 amps. for mains and large service lines. The house service thaws in 3 min. at the 400 amp rate. Records for 11,000 services indicated average costs just half that for the transformer thawing method. A charge is made at $3.00 per half-hour for a thawing operation.

Mr. Stockwell reported that the thawing machine is used also for energizing mains in main location work. Since Ottawa mains have 7 to 7½ ft. of cover the location work is vastly simpler and more certain when the generator set is used to charge the pipes.

## Hugh Dewey Becomes President of Western N. Y. Water Co.

**Hugh S. Dewey**

This might well be titled, "A Big Man Gets A Bigger Job" for Hugh S. Dewey is a big man and his new job is that of President of the Western New York Water Co. Since 1930 Hugh Dewey has been Vice President of the company with headquarters in Buffalo where the company serves much of the suburban area surrounding the city of Buffalo.

The company is a subsidiary of the New York Water Service Corp., which in turn is owned by the Federal Water and Gas Corp., formerly the Federal Water Service Corp.

Hugh Dewey is well known, not only on the Niagara Frontier but throughout the state and the country through his work in the water works field. Hugh is a past chairman and past trustee of the New York Section of AWWA and is now serving AWWA as a Director from the New York Section.

## Findlay, Ohio Has Overloaded Plant

**Annual Report Discloses Expansion Needs**

The 1944 Annual Report of the Findlay, Ohio, Sewage Treatment Plant carries in its letter of transmittal the serious problem which confronts the city in regard to the overload on the treatment plant. Mr. Ben H. Barton, Chief Operator, writes as follows in his letter to the sup't of the plant:

"The attached annual report or Operation . . . indicates an acceptable degree of treatment but does not disclose the conditions which must be promptly corrected to assure continued acceptable treatment of sewage and garbage.

"Attention has been repeatedly drawn to the need for additional digestion and sludge disposal (capacity). The plant personnel has coped with the situation by many and various stopgaps to their own disadvantage. The city officials have accepted our efforts as unfailing and in the apparent expectation that the plant personnel will always come up with each and every solution.

"This letter of transmittal constitutes a formal and final notice that without added facilities for proper plant operation immediately, there are two alternatives:

"1. Fill Rawson Park with digester overflow liquor.

"2. Take secondary treatment out of service.

"Residents adjacent to the plant site will not tolerate the first alternative and it is not expected that the State Dep't of Health will permit the second. . . ."

We have always had a healthy respect for Ben Barton's ability not only to operate a sewage plant but to evaluate his problems. We hope the city of Findlay feels the same way about Mr. Barton's report.

# LOCATING WATER LEAKS THE MODERN WAY

By ALAN D. DRAKE
Director
Division of Water
BUFFALO, N. Y.

The Author

THE Buffalo, N. Y., Division of Water gave the modern touch to leak detection when on September 27 it took full advantage of modern electrical and mechanical conveniences, including the use of radio message transmission, in running down a 1,750,000 gallons per day leak on Buffalo's fire system. The Buffalo high pressure fire system consists of 394 valves, 222 hydrants, and 15 miles of mains of which 72 per cent consists of 16 and 20 inch pipe, and roughly 28 per cent is of 12 inch size.

With the exception of the supply mains from the pumping station, the system is confined, generally, to the downtown congested, high value district. It is kept primed with purified water to about 70 psi. through an 8-inch bypass from the domestic system at the principal pumping station. The low pressure flow into the system, is entirely leakage, and is measured by a 6-inch compound meter on this bypass.

### *Meter Shows High Water Loss*

Just previous to September 27 an alarming increase of 160 cu. ft. per min. in the flow through this meter gave conclusive evidence of an extremely large leak on the fire system. The usual manifestations of a leak of this magnitude, such as surface indications, depressed pavements, flooded cellars, and overloaded telephone switchboards, were entirely lacking.

In an endeavor to locate the leak as quickly as possible it was decided to take full advantage of the fact that the lost flow was being metered and to adopt the familiar section subdivision method of leak detection.

An auto "talk-back" radio was used to receive and transmit messages between the valve turning crew and the meter reader at the pumping station. Consequently, about one minute after a valve was closed, isolating a block or section of the system, the effect on the flow through the meter, as observed by

**Operating Valves with Dean Operating Machine**

*(Power take-off from truck motor makes short order of this otherwise laborious and time-consuming job)*

the meter reader, was communicated to the valve crew, perhaps four miles away, by radio transmission and reception. All messages were relayed through the Buffalo Police Station (WMJ) operating on an assigned frequency of 2422 kilocycles.

### *Mechanical Valve Operation*

All valves were operated mechanically using Dean Valve Operating Machines attached to a repair truck. The great majority of the valves operated are 16-inch geared valves requiring as high as 200 full turns to close. However, with the Dean operating machine closing of even the largest valves required a matter of only a few minutes.

After the subdivision method had run down the leak to one particular block the exact location of the leak was determined by taking amplified pavement vibration meter readings using an electric leak detector as a measuring device.

When the pavement over the leak had been broken through and the water pumped out, a washout 16 feet deep, 14 feet long, and 7 feet wide was disclosed. The water had escaped through an old 12 inch brick lateral sewer and also directly into a 24 inch tile sewer, 3 feet south of the leaking main. A well reinforced pavement carried heavy industrial truckloads over the washed out area without any indication of the washout. Were it not for the reinforcement supporting the heavy street loads the existence of the leak through an undesired pavement failure might have been revealed much earlier.

The leak was due to a well-opened 30 inch crack at the end of and on the under side of a 16 inch pipe.

### *Success in Six Hours*

From the start of the investigation to the time when an exploratory hole drilled through the pavement proved the leak had been definitely located, 15 miles of pipe had been covered or eliminated, a 1,750,000 gallons per day leak had been located, and just under six working hours had elapsed.

The total leakage from the high pressure fire system was reduced to 15,000 gallons per day after the cracked pipe causing this leak had been repaired.

The work performed was under the direct supervision of William H. Grotz, Assistant Engineer of Extensions, and Frank O'B. Nehin, Hydraulic Engineer. Edward J. Brady, Superintendent of Maintenance, has direct supervision of all water main repairs on the Buffalo system.

**Two-Way Radio**

*(Being operated by Ass't. Engr. W. H. Grotz; proved of incstimable value)*

**Electrical Leak Location Equipment**

*(Vibration readings being taken by Hydraulic Engr. Frank Nehin spots the leak)*

## Dallas' Noteworthy Master Plan for Water and Sewer Utilities

Under the direction of Homer A. Hunter, Sup't of the Dallas City Water Works, the engineering staff of that department has prepared a master plan for the development of the city's water and sanitary sewer systems for the future. The plan is based on the prediction that the population to be served by these two utilities in 1970 will be 667,000 persons.

The report is divided into four parts, the first of which is devoted to a brief history of the development of these utilities for the city. The second section is a description of existing facilities while the third section gives a summary of future needs for expansion. The fourth section sets forth in detail the proposed method of financing the expansion of the system for the next twenty-five years.

That Dallas has heeded the gospel of **Blueprint Now** is evident from the fact that detailed plans and specifications are now complete for work which will cost almost $1,000,000. Consulting engineers have been employed to prepare plans for a water treating plant extension which will cost approximately $750,000. This master plan actually combines post-war plans with long range planning. Actual accomplishment of the plan, as far as construction work is concerned, can begin as soon as material and labor become available.

## Latin America Plans for Sanitation Developments

### Venezuelan Aqueduct

Venezuela's National Institute of Public Works has signed a contract with a United States firm for the construction of a new aqueduct in Caracas. Work is to begin immediately and will cost approximately $24,000,000. The new aqueduct will be one of the largest of its kind in Latin America. Four reservoirs will be included in the system and these will have a capacity of 15,700,000 cubic meters. The system is designed to supply an average of approximately 320 liters per capita per day (85 gpcd). Mr. George C. Bunker, honorary member of AWWA is Consulting Engineer, Technical Service, of the National Institute of Public Works.

# THE POROUS PLATE FILTER UNDERDRAIN SYSTEM*

## For Rapid Water Filters and Softeners

By FRANK C. ROE
The Carborundum Co.
PERTH AMBOY, N. J.

FOR the benefit of those who do not already know, a brief history will be sketched before outlining the attributes of the porous plate filter underdrain system, and the essential details of design and experience with this type of filter bottom to date.

The idea of completely eliminating all graded gravel and lateral drains from water filters, and replacing with a relatively thin and rigid porous membrane is now almost of voting age. During the 1920's the idea occurred to a few engineers who were interested in checking filter bottom troubles, such as non-uniform backwash with resultant mud balls, loss of sand, cementing of gravel and the ultimate necessity of regrading and rebuilding filters. Also, they were thinking of reducing costs and eliminating corrosion.

Harry N. Jenks tried a Portland cement bonded pea gravel slab with wash water distribution laterals formed

The Author

therein at Sacramento, California. Messrs. Gore, Nasmith and Storrie had somewhat earlier tried a similar design at Windsor, Ontario. Then, at the University of Texas, F. W. Jessen and J. N. Hinyard installed a false bottom of plain vitrified porous plates in an experimental plant. Later Prof. T. R. Camp of Massachusetts Institute of Technology tried the same idea in an experimental installation at Providence, R. I.

From a functional viewpoint all of these ideas were eminently encouraging. However, the Portland cement bonded slabs soon disintegrated and that type of material had to be abandoned. The vitrified porous ceramic plates proved resistant to corrosion and disintegration, but the pores of the first plates used were so fine that early clogging developed. Such clogging did not respond to any practical and economical use of solvents, backwashing or other treatment.

### *Development of the Aloxite Bottom*

During 1933, The Carborundum Co. began the development of porous plate underdrains which would (1) resist disintegration and corrosion, and (2) provide a large pore, low friction, non clogging medium, which would insure uniform distribution of wash water and filtration rates.

This material approaches in structure the finest grade of gravel or torpedo sand used in the conventional graded

*A paper read before the Missouri Water and Sewerage Conference, the reproduction of which has been authorized by the Conference.

**An Early "Aloxite" Porous Plate Bottom in One of the Grand Rapids Filters**

*(This picture constitutes something of an optical illusion. Actually there are less than two bolts per plate; if you don't believe it, just count the bolts for any eight or more plates.—Ed.)*

gravel support for the sand bed of rapid filters. Thus, the probability of clogging is eliminated and effective standard practice of backwashing filters is assured.

The first plates were made with moulded-in channels on the underside, corresponding to pipe laterals in some of the conventional designs. These channels connect with a central manifold, and filter operation is similar to the usual manifold and pipe lateral system. This early design corresponds to the work done by Jenks in Sacramento, Calif., and is, in fact, covered by a patent issued to Mr. Jenks. This design does possess a definite advantage where filter structure height must be minimized to an extreme. However, a later false bottom design has the well known advantages of the generally accepted false bottom for rapid sand filters.

Plain "Aloxite" plates were developed for the false bottom and a design was established similar to that here illustrated. This has proved to be the most popular design because it is both practical and economical. The plain plate system now runs about $2.05 per sq. ft. for material, whereas the channeled plates are approximately $4.00 per sq. ft.

### *Benefits from the Porous Plate Bottom*

Now that the background and basic idea of this development has been presented it may be in order to enumerate the several advantages, most of which can be readily appreciated by looking at the accompanying line sketches of the filters.

### *Uniform Backwash*

Backwashing of filter media is positive and uniform with the porous underdrain system. Uniform suspension of the entire filter bed during backwash is inherent, since the entire filter bottom is covered with porous plates beneath which a uniform water pressure exists.

Satisfactory washing of every portion of the filter eliminates the well known objectionable mud balls; the bane of the filter operator's life. Good washing also reduces the total quantity of wash water required; an important saving.

### *Protection of Filter Media*

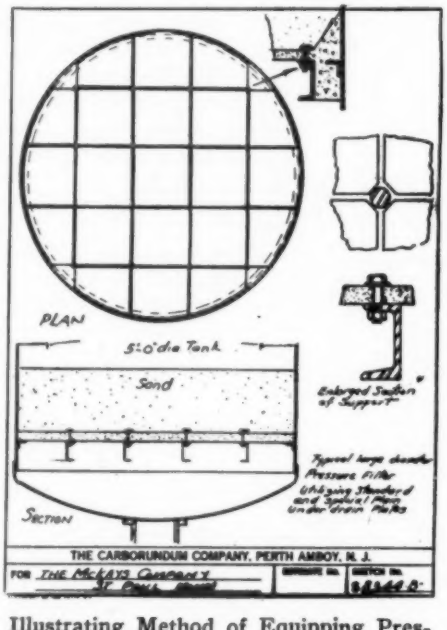
In the older conventional underdrain systems, a really uniform backwash maintains graded gravel and sand in equilibrium, i.e., with the finest material on top. However, if there is any irregularity of washing, sand is often lost by washing out over the wash troughs or leakage through the graded gravel and underdrainage system. If the backwash becomes very non-uniform the graded material may be entirely disrupted and mixed. The net result is not only loss of sand and general inefficiency, but the necessity of rebuilding or careful regrading of the gravel at heavy expense.

With porous plate underdrainage, it is impossible to lose sand. Even if backwashing were non-uniform, the filter could not be upset, as only the one grade of filter media is used, and lateral movement will cause no trouble.

This particular benefit is outstanding in connection with the use of Zeolites for softening, because of the high relative value of such materials.

### *Low Construction Cost*

Since the porous underdrain system eliminates the use of graded gravel at the outset, the height of filter structure can be reduced by almost the depth of such gravel. This construction economy may apply to the entire filter building and to its excavation in some instances, as well as to a reduction in vertical pipe lengths, etc.




**Illustrating Method of Equipping Pressure Type Filters and Softeners with Porous Plate Bottoms**

*(Periphery plates are "tailor-made" at the factory for exact shell diameter. No gravel bed to blow up.)*

### *Low Improvement or Rehabilitation Cost*

The fact of reduced overall filter depth with porous plate underdrainage makes it possible to successfully operate old plants originally designed for low rates of backwash. By installing such a system the filter media may be dropped enough below wash troughs to apply as high rates of wash as may be necessary for satisfactory results.

Other rehabilitation problems such as increasing the depth of sand or using the recommended greater depth of "Anthrafilt" are solved by using porous plate underdrains.

### *Low Operation Costs*

Again, because the porous underdrain system permits a reduced filter height, as compared to graded gravel underdrainage, the elevation to which water must be lifted for filtration will be lowered accordingly in a number of cases.

The loss of head through porous plates during backwash is much lower than through many other types of bottoms. While this effects but a small saving in power it is a cumulative saving.

### *Surface Wash*

All surface wash equipment, including the new Palmer revolving agitator, work to best advantage with the porous underdrain systems. Water may be discharged from jets at high velocities if desired since there are no layers of gravel to be disturbed. Low rates of backwash, as suggested in conjunction with surface wash, are as uniform as high rates.

### *Air Wash*

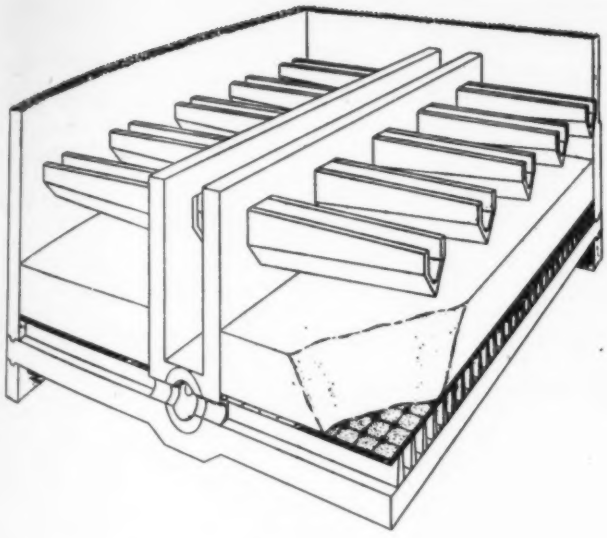
Air wash as used to supplement normal water wash under certain conditions may be simply applied with porous underdrain plates. They act as diffuser media providing uniform distribution of air over the whole filter area. This advantage effects a saving in construction cost by eliminating the customary grid of perforated air-wash piping.

### *Filter Design and Construction*

In general, the design of rapid filters utilizing the porous underdrain system conforms to the usual filter design with the exception of reduced vertical dimensions resulting from the elimination of graded gravel. Rectangular gravity filters should be designed with even foot dimensions in both directions if possible because standard plates are one foot square. Construction and installation are thus simplified. In adapting underdrain plates to old filters with fractional foot dimensions, single rows of narrow plates may be used as they can be especially manufactured. Special plates of any radius cut to fit the periphery of circular filters can also be made.

An allowance of ⅛ in. for sealing of joints between plates must be made in all designs. Standard plates are actually manufactured 11⅞-in. x 11⅞-in. square so that supports may be located at even foot intervals, leaving the required ⅛ in. between plates.

There are several ways in which plain plates can be installed as a false bottom. Probably the most economical design is the concrete structure shown in the accompanying line drawing. Where conditions will not permit a center manifold as shown and wash water must be introduced at one or two points, ample openings should be made between the plate supporting ridges to maintain uniform pressures throughout the space below the plates. The vertical space between plates and filter floor varies with filter area. It is based on the practical elimination of velocity head loss of wash water in channels between ridges. A space of 6 in. in



**Most Economical Design of Porous Plate False Bottoms for Gravity Filters**

*(Central manifold and ridge plate—supports of concrete. However, both steel and timber have been substituted for concrete as supporting ridges.)*

small filters and up to 10 in. in larger units is customary.

Concrete pilasters at each corner intersection of plates is an alternate design often considered. Plates are installed the same as with the concrete ridge supports. A similar idea is the use of long bolts anchored in the floor with two sets of washers and nuts at the top, supporting and holding down plates at the desired elevation.

Both structural steel and timber have been used to support plain plates on certain installations where the character of the water has little effect on such materials.

Porous underdrain plates lower the cost of pressure filters and softeners considerably because of the reduced depth when graded gravel is eliminated. The design is usually a simple structural support for plain plates—see illustration. Similar construction can be used on horizontal filters, structural supports being welded to the wall at right angles to the filter tank axis.

For small pressure units of 36-in. diameter or less, single plain discs can be used without any structural support other than a flange around the periphery. Pressure filters of this design, must, of course, be manufactured so that the top can be completely removed to permit installation of circular plates of the full tank diameter.

### *Plate Installation*

Underdrain plates must be anchored to prevent uplift during backwash. Where aggressive water is encountered, corrosion resistant bolts must be used. "Everdur" has proved satisfactory but other materials such as stainless steel, brass, and Ihrigized, Sherardized or galvanized iron can be used with equal success depending on the character of the water.

For new construction, carriage type bolts anchored in the concrete ridges or pilasters are probably lowest in cost. A washer and nut are used above plates.

Perhaps the lowest cost corrosion resistant material for filling of joints is a mortar or grout of "Lumnite" cement and sand. This can be mixed to a consistency that will permit "buttering" of plate edges as they are set, leaving tight joints. Additional cement is trowelled into the top of the joints as they are finished. Portland cement has also been used successfully for joint sealing but may not be permanent in resistance to corrosion.

Under some conditions it may be desirable to use other types of corrosion resistant materials for joint sealing such as phenol free bitumens or asphalt. When installing plain plates it is necessary to maintain the consistence of the bonding material at a point where it will not run out of unsupported joints when plates are set.

A new corrosion resistant material which also has tremendous adhesive strength is "Carbozite."

### *Physical Properties*

"Aloxite" porous underdrain plates are made from ceramically bonded grains of fused crystalline alumina ($Al_2O_3$), a hard inert material used extensively for abrasive and refractory products.

The plates are kiln burned at high temperature to completely vitrify the bond which holds the individual grains together. This process renders plates permanently resistant to any corrosion effect of water to be filtered. They will even withstand acids or mild caustic, the use of which may be desirable for cleaning from time to time. They will also withstand ordinary temperature changes including blow torch flame for asphalt application in joint sealing.

"Aloxite" underdrain plates are sufficiently strong and rugged to withstand all conditions of installation and operation. Plates may break if dropped, since they are ceramic products, but they may be walked on and loaded up to 1000 lbs. per square foot without danger.

**A Highly Successful Recent Porous Plate Bottom Installation**

*(At Lyons, N. Y., the "Aloxite" porous bottoms were adopted in conjunction with the revolving Palmer Filter Bed Agitator and full depth of "Anthrafilt" as the filtering medium. The result has been outstandingly satisfactory)*

**A Recent Neat Installation of Porous Plate False Bottoms**
*(Illustrative of the advantage of having the filter box of wall-to-wall dimensions to the even foot.)*

### *Filter Operation*

Normal operation practice as employed on rapid filters with any other type of underdrain system should be followed on filters equipped with the porous underdrain system. Standard rates of filtration, allowable loss of head through filter media before backwash, rates of backwash, etc., should be maintained. Wash water must be taken from the filtered supply as is, however, customarily the case.

Probably the first question occurring to engineers and water superintendents who become acquainted with this system is "Will the plates clog?" The answer is a decided NO, with no qualifying statement other than that normal and reasonable operating practice must be followed. As previously suggested, solids which might pass through the usual filter media will also pass the "porous" supporting structure.

Overloaded filters or inadequate pretreatment may cause fine alum floc or other minute coagulant solids to penetrate the filter bed. Such solids will normally pass through porous plates but continued presence may cause gradual clogging. Fine alum floc is simply and economically removed from porous plates by saturation with 2 per cent sodium hydroxide in an overnight treatment without removal of filter media. Incidentally this treatment also cleans the filter media.

### *Experience History*

At this writing, there are more than 100 installations of "Aloxite" porous underdrain systems in operation. Some of these are small pressure units but many are large, ranging up to 15 mgd. capacity per day. These are located all over the world. Consequently they are in use on all types of water and are operated under all sorts of conditions. The fact that no trouble of any consequence has occurred under these widely varying conditions speaks for the basic soundness of the idea and the ruggedness of material and construction.

A few of the larger installations follow:

**Typical Installations of "Aloxite" Porous Underdrain Systems**

| Location | Year |
|---|---|
| Denver, Colo. | 1936 |
| Grand Rapids, Mich. | 1936 |
| Midland, Mich. (Dow Chemical Co.) | 1937 |
| Mamaroneck, N. Y. | 1937 |
| Nykoping, Sweden | 1937 |
| Singapore, Straits Settlement | 1938 |
| Grand Island, Neb. (Swimming Pool) | 1939 |
| Bogota, Columbia, S. A. | 1940 |
| Alcoa, Tenn. (Al. Co. of America) | 1941 |
| Lima, Ohio | 1941 |
| Danville, Ill. (Water Co.) | 1941 |
| Dearborn, Mich. (Swimming Pool) | 1941 |
| Ft. Smith, Ark. | 1941 |
| Cody, Wyo. (U. S. Army) | 1942 |
| Camp Chaffee, Ark. | 1942 |
| New Brunswick, N. J. | 1942 |
| Norfolk, Va. (Army Base) | 1942 |
| Port Neches, Tex. (Butane Prod. Co.) | 1942 |
| Calexico, Calif. | 1943 |
| Menominee, Mich. | 1943 |
| Port Arthur, Tex. (Gulf Oil Corp.) | 1944 |
| Edinburgh, Tex. (Central Pwr. & L. Co.) | 1944 |
| Philadelphia, Pa. (Gulf Refining Co.) | 1945 |
| Flat Rock, Mich. (Ford Motor Co.) | 1945 |

(Note—At this writing there are more than 100 installation of "Aloxite" porous Underdrain Systems. From the list supplied we have selected the above as representative of the more important installations.—Ed.)

A few installation experiences have suggested the following recommendations to engineers and superintendents:

(1) All plates and supports must be thoroughly bolted down and all joints carefully sealed; neither of which is difficult.

(2) If wash water inlets are vertical a baffle should be installed to prevent direct impingement against plates.

(3) If a considerable difference in temperature is possible, there should be one expansion joint between two rows of plates in each filter or between an end row and adjacent wall.

### *Conclusion*

Eight years of generally successful experience indicates that the porous plate system is a simple, practical and economical method of underdrainage for rapid filters and softeners; that it eliminates the trouble of graded gravel underdrainage; and that it is adapted to almost all rapid filtration problems.

## E. S. Rankin, Newark's Chief Engr., Passes

Edward S. Rankin, Chief Engr. of Newark's Division of Sewers and Secretary of the Essex-Union Joint Meeting, died on March 8 at the age of 84.

Mr. Rankin entered the city employ in 1887 as an assistant surveyor of streets at $75 a month. In 1903 when the city engineering corps was organized he was placed in charge of sewers and was named division engineer in 1929.

During his career with the city, Mr. Rankin often was called on to advise other municipalities on sewerage problems. He designed the sewerage systems of Belleville and Nutley and was the long time secretary of the Joint Meeting which served 11 communities (including Newark).

Mr. Rankin was president of the Amer. Soc. of Municipal Engrs. in 1922 and in 1930 the society conferred on him its first medal of honor. Mr. Rankin was also a member of ASCE.

## Barron Leaves Nassau County, N. Y.

### Becomes San. Engr. for National Biscuit

J. Lloyd Barron, well known director of the Division of Sanitation of Nassau County, N. Y., has resigned that position which he has held since 1938, to become Sanitary Engineer for the National Biscuit Co. Mr. Barron's office will be at 449 W. 49th St., New York City, and his new work will include supervision of the sanitation of milling and manufacturing plants of National Biscuit throughout the United States.

# THE PLACE OF PUBLIC WORKS IN PLANNED POST-WAR CONSTRUCTION*

By COL. WILLARD F. ROCKWELL
President, Pittsburgh-Equitable Meter Co.
PITTSBURGH, PA.

The Author

IN THIS great country of ours, it is the precious privilege of all political parties to present preposterous preëlection promises of prosperity, and after victory or defeat, to leave their procurement to posterity.

Everyone will agree that taxes can have a drastic effect on business, but few will agree that politicians of any party have found any method of improving the condition of citizens by state socialism or by government planning of all enterprise. There are certain definite functions of government, and these are properly divided into federal, state, county, and local community functions. Such necessary government operations and functions usually require the construction of buildings and public works, which should be planned far in advance of needs, with the definite object of improving the welfare of all the citizens. Public works projects should be planned when private business is good and executed when private business is bad. The work should definitely be planned to take up the slack of business depressions, not only because it fits the people's needs, but also because it permits such work to be done at far lower costs than prevail during times of good business, which is also for the permanent benefit of the public. Bonds can be sold with very low rates of interest if the public works are of a definite utilitarian value and so planned as to guarantee their future usefulness to the community.

A few years ago, we had 30 million workers producing 65 billion dollars per annum, and some economists believe we should have in the post-war period 60 million workers producing 140 billion dollars in goods and services. Admittedly, a strong dose of inflation can make 65 billions look like 140 billions, but it will not add 30 million workers to pay rolls. Most economists seem to agree that private enterprise cannot furnish so many jobs for years to come. Some economists doubt even that we want more than two out of every five people on the pay rolls, since young people require time to be educated and old people must be retired for various reasons before their life span has passed.

*This paper was read by the author before the New England Water Works Assoc., Jan. 11, 1945, and is here reprinted by permission of the Association.—The Editors.

## *Government Work in Our Economy*

Government work has always had a place in our economy, and its planning offers one of the greatest possibilities for preventing unemployment and maintaining progress in our industrial advancement. This nation has the highest standard of living in the world and in three years has produced the greatest fighting power in history, because we are the most advanced industrial nation in the world. It is industry that has mechanized our farms and homes and enabled us to produce more with less physical effort, and, in some cases, with less mental effort, so that we have more time and more brains to devote to further mechanization. In such countries as India and China, where less than one per cent of the people are engaged in industry, we find the lowest standards of living and the least ability to oppose foreign oppressors.

So impressed were we with this address made by Colonel Rockwell before the New England Water Works Assoc. that we sought and received permission to reproduce it for the benefit of the readers of *Water Works and Sewerage*.

It, in our opinion, represents the clearest statement pertaining to public works construction, with or without Federal aid in a planned post-war national economy, that we have yet heard. We heartily recommend its careful reading.

One of our first Federal ventures in business was the Post Office Department. While its operations are generally considered satisfactory, and are conceded as a necessary Federal function, it furnishes examples of the complaints against Federal operation and control. Wages are low, the work is hard, and opportunities for advancement are very limited. There has been no increase in basic wages in 20 years. The higher positions are not filled from the ranks, but are reserved for political rewards, without regard to merit. Because the post office is essentially a monopoly, there is no check on the efficiency of its operations or its relative cost. It is, however, typical of government enterprises in which the three greatest handicaps are: (1) failure to provide sufficient incentive to the workers and active management; (2) inability to determine proper costs and efficiency of operation; and (3) constant danger that whichever political party is in power will exploit the political possibilities rather than improve the service.

In the recent elections, a number of propositions to permit further acquisition of properties for operation by federal, state, or local governments were defeated; and there seems to be a strong public reaction against government ownership and control. Furthermore, both major political parties emphasized their belief in the competitive, free enterprise system. Any public reaction against state control, however, should not be permitted to limit or hamper government in the exercise of necessary functions.

## *Necessary Government Functions*

One of the first of these functions prescribed in our history is the protection of the health of the people. The United States Public Health Service was established in 1798, and its duties include:

1. Prevention of interstate spread of diseases and suppression of epidemics.
2. Cooperation with state and local health boards.
3. Investigation of diseases of mankind.
4. Supervision and control of biologic products.
5. Collection and publication of vital statistics on health, etc.
6. Compilation and dissemination of public health information.

Our U. S. Public Health Service has been credited with the suppression of yellow fever in the South and control of bubonic plague in California, Puerto Rico, and Louisiana, which certainly justifies its existence. The importance of this Federal function cannot be minimized in view of the fact that good health is the first essential in any plan for a higher standard of living. The military leaders of Germany started a health movement as one of their first steps in the great military program that has come so close to conquering the entire civilized world.

Small nations have been wiped out by plagues, and even the most civilized nations today suffer a great loss of efficiency by the prevalence of diseases that fill our hospitals and reduce the efficiency of all workers. Poor health is a cause contributory to mental troubles and to all kinds of moral delinquency which fills our jails and other public institutions. If we can improve the public health, it will release hundreds of thousands of workers for more productive employment and will increase the productive working time of every citizen. This, in turn, will increase the wealth of the entire nation.

It is difficult to conceive of anything that should be of more interest to the entire public and less subject to criticism than a program for public expenditures that will promote public health. In times of depression, the world is particularly vulnerable to epidemics and, even more so, following the ravages of war. The difficulty of providing proper facilities and maintaining public services enhances the possibilities of epidemics and, therefore, increases the necessity for public expenditures to promote better health.

### *The Field of Public Health Service*

In this field of public health service, there are two activities that are of vital importance to all mankind, and that cannot be separated. These are: the maintenance of a relatively pure water supply, and the proper disposal of sewage. Throughout human history, the improper disposal of sewage has been the greatest obstacle to providing a supply of good water. Water is absolutely necessary to all terrestrial life, but because water is a great solvent, commercially pure water is produced only in laboratories.

We know that the water furnished a community will affect the vitality, the appearance, and the general health of the individual from the cradle to the grave; and it is a very important factor in the cost of living, especially when its neglect affects the length of life or reduces the energy and efficiency of the people. It has been demonstrated that a small amount of flourine has a pre-natal effect on teeth, and in some communities, accounts for almost perfect teeth, with great resistance to decay; and, on the other hand, a very slight increase in fluorine content results in discolored teeth and dental difficulties of a very serious nature.

Every waterworks man is aware of the problems in maintaining a satisfactory water supply in his own community, but if he takes a transcontinental air trip by daylight, he will be profoundly impressed by the problems of other waterworks' men. He will see the clear blue water of the mountain lakes, such as Arrowhead and Tahoe; he will see the brown waters of the Missouri and the Mississippi; the red, green, and yellow waters, and the thick, white alkali waters of semi-arid states; the black waters of the forest states; and he will doubt that there is any color in the spectrum that cannot be found somewhere in this country in the raw water supply of some community. Because of its abundance, the old alchemists overlooked water as the universal solvent, but we know that sea water contains gold, magnesium, and nearly every known element; and chemicals dissolved in water constitute a great problem for waterworks' men. But chemical problems are no greater than bacteriological, vegetable, and potability problems. Tastes produced by algae are always a problem; and in all chlorinated waters containing phenol, we produce other tastes that are very objectionable, even when they are recognized as necessary to disease prevention.

The operator from the semi-arid states who flies over the Great Lakes may think that Chicago, Detroit, and Buffalo cannot have any water supply problems, but he will learn that they have many problems, most of which originated with careless sewage disposal. Millions of dollars are spent to make these waters potable, to remove certain chemicals, to supply other chemicals, and to provide the pressure to put the water where it is wanted. Millions more are required for disposing of waste water; and again, we find we cannot separate sewage disposal from water supply.

### *No Excuse for Waste*

There is no place in this country where there is any excuse for wasting water. Regardless of its abundance in any locality, it must be distributed to the ultimate consumer; and waste requires an oversized system, which means a greater investment and, therefore, higher taxes. Waste water proportionately increases the size of the sewerage system, the cost of treatment, and the problem of disposal.

Experience in many communities has shown that the installation of water meters reduces water consumption by 20% to 50% by reducing waste and thus reduces proportionately the investment in water and sewage systems and the cost of treating and pumping both. Some sewage disposal experts are recommending meters on discharge lines, so that sewerage costs can be allocated according to actual use. Buffalo, where water is so plentiful, has the problem of reducing water waste or spending millions for more sewerage system capacity.

The requirements for relatively pure water are obvious in industry, beginning with the water supplied to steam boilers in our power plants and extending through the chemical industry, the paper industry, and the food industry as examples. Many industries that are interested in new locations are attracted or discouraged by the quantity and quality of the water supply. Furthermore, the supply is an indication of the efficiency of local government and of the economy and wisdom exercised by the citizens who are responsible for the election and appointment of officials who are so important to the public health and welfare. In many communities, it has been demonstrated that the savings due to water softening are reflected in the domestic soap requirements, and in war time, there is always a shortage of soap making materials. No one can say how much is lost by the more rapid deterioration of our clothing and other textile requirements when they are washed in hard water.

Infantile paralysis is an example of the epidemics of unknown origin that may be traced to water contaminated by sewage. Nearly every community has had occasional minor health disorders of epidemic proportion that are attributed to water contaminated by sewage. The subject of stream pollution is largely a matter of Federal regulation, because of its interstate character. Records indicate that sewage disposal plants can be self-sustaining, and there is accumulated evidence that some recovered materials may make an important addition to greater soil productivity, in addition to removing a most serious menace to public health.

Many of our great river valleys, such as the Ohio, present horrible examples of good water sources continuously contaminated by sewage and other wastes. Communities near the source, using good water provided by nature, discharge their wastes downstream so that other communities, less fortunately situated, must spend enormous amounts of money for water purification; and they, in turn, discharge sewage into the same river to add to the problems and taxes of other cities downstream. It has been definitely demonstrated that the proper planning, construction, and operation of sewage disposal plants is one of the most profitable public enterprises that can be undertaken; but, in many cases, it is difficult to have one community assume the expense when it is obvious that the investment will benefit another community downstream.

As far back as 1892, there is a well authenticated record of water-borne disease being prevented by suitable

water purification. The city of Hamburg took its water from the River Elbe and discharged its sewage into the river, and the downstream city of Altona had installed filtration more than forty years before. In 1892, Hamburg had 2,630 cases of cholera per 100,000, with a death rate exceeding 50%; while in Altona, the case rate was less than one-sixth as great and these few cases were believed to have been acquired in Hamburg. This demonstrated that a community, which protects its own interests, can only secure complete protection by aiding other communities with which it has contacts, whether upstream or downstream. We cannot guarantee public health if we do not help all our neighboring communities to solve their problems.

### *Municipal Development and Planning*

The record of the development of this country shows that the probable growth of nearly all communities can be forecast with reasonable accuracy. However, there are very few instances where any community, large or small, has planned sufficiently well in advance for future requirements of water and sewage disposal. As a result, many communities have been burdened with heavy investments and heavy taxes, which certainly could have been drastically reduced if there had been real community planning. The City of New York affords a good example. Many millions are being spent, and many more will have to be spent in the near future, to acquire watersheds, transmission and distribution systems for the water supply, and still more millions for sewage disposal. The city has faced a dangerous shortage of water many times, because the increasing requirements have not been properly computed and the necessary advance steps have not been taken to provide facilities. The blame cannot be placed on the present administration, nor on any particular administration in the past. Every large city in the country, and many small cities, have spent very large sums in condemnation proceedings and legal battles to obtain additional water supplies, involving unnecessary millions of the taxpayers' money because of the failure to plan in advance for future needs.

If we have proved our case that water and sewage works should be planned in advance, and constructed whenever there is a slowing down of private enterprise, so that these public works can be used to take up the slack and take advantage of lower costs, then the present problem is proper planning. A few months ago, Federal authorities advised post-war planning, but the sudden announcement of munitions shortages, linked with civilian manpower shortages, has brought the warning that we must devote every effort to winning the war; and surely no one will disagree with that conclusion.

Nevertheless, there are many who cannot contribute directly to the war effort, but who are essential to our civilian activities. Among these are our waterworks and sewerage executives and engineers. The very shortage of manpower that eliminates ordinary replacements, maintenance and extensions, will give these men more time for planning post-war work. Some of them must devote their time during the war to take care of water and sewage problems involved in the housing of war workers in crowded defense areas, but there are many cities in which the planning of public works will not impede the war effort and will contribute to the public welfare by reducing the problem of post-war employment. The great advantage of such public works planning is that it can be brought into use if unemployment is threatened and can be suspended if there is either a postponement of peace or a period of high employment following the peace.

### *The Place of Federal Aid*

An essential part of the planning is the best method of raising funds and making a proper return on the investment. There is no doubt that the best plans can be prepared by local authorities with professional advice, but they must often be coördinated with plans of other communities that have a mutual problem of water supply and sewage disposal. In some cases, this will necessitate Federal action, and this is the point where every community must take its stand on Federal aid.

The general opinion that Federal funds constitute a grab bag to which no particular community contributes, but in which every community should seek a large share, must be analyzed. This opinion has resulted in the waste of billions of dollars, starting with the extra cost of such funds, which cannot be explained better than in a speech made by Judge Hatton Sumners in Congress in 1921, in which he said:

> In the first place, if they (the States or communities) are to get money in this way, Congress must take some time to provide the appropriation and the people of the country have to pay for that. Then we send down to the States and get this money from the people by taxation. There is nowhere else to get it. We attach an overhead charge for its collection and the people have to pay for that. We bring it up here and cover it into the Treasury and the people have to pay for that. Then we send it out to the States and the people have to pay for having it sent back to the very place where we got it.

Fortunately for the nation, Representative Sumners is still in Congress, and he recently repeated his warning that the most expensive form of community enterprise originates with the demand for Federal funds. It was one of the most frequently expressed opinions of the founders of our Constitution that all possible Governmental powers should be delegated to the states and to local communities.

It must be obvious to anyone that we cannot build up a staff in Washington large enough to plan the future needs of every community in the nation. If our public works are not properly planned, they are sure to be wasteful; and that means higher taxes for everyone. Furthermore, if the appropriation of funds is made in Washington, it is almost certain that the allocation will be based on political considerations, rather than on the particular economic requirements of any community.

Any survey in any part of this country where Federal funds have been spent will show that billions have been wasted, either as a result of improper political considerations or impractical planning. You will find expensive post offices in tiny hamlets and antiquated post-office facilities in larger communities. You will find public roads representing an investment that will never be repaid by the traffic that is carried, and you will find other Federal roads that have to be widened and changed at enormous expense, because they were improperly planned for the loads to be carried.

The Rivers and Harbors Bills passed by Congress have been denounced as pork barrels for a century. Everyone knows that millions have been spent for harbors that never had the commerce to justify the expenditure, because the politicians of the particular party in power wanted the good will of that area; while other harbors that should have been deepened have been neglected because the politicians felt that there were not enough possibilities for collecting a block of favorable votes.

If our people insist on Federal aid, we must expect more and more Federal domination of local affairs. The theory that the Federal funds are a boon to every community that receives them, is utterly untenable; whereas, Federal waste of any kind must be repaid by taxes that become an obligation of every citizen.

### *Then—What Are We Waiting For?*

Our country has lived through many depressions, and it cannot be denied that they could have been lessened if we had planned public works projects and promoted them to prevent unemployment; and the cost of such measures would have been justified both by the low cost and the great saving due to anticipation of requirements.

When the planning and building of water and sewage works are carried out by local communities, it is certain that careful scrutiny by interested taxpayers will assure maximum results at minimum costs, provided that we have competent engineers and executives in charge. It is a public duty to see that the highest available type of skill is employed and properly paid for the planning and operation of waterworks and sewage disposal plants. When such public works, as water and sewage utilities, offer the opportunity to save millions, improve public health, increase industrial efficiency, lower taxes, and vastly improve our standard of living, the only question that arises is: *"What Are We Waiting For?"*

## Sixth Buffalo Report

### Costs Increase with Salary Raises. Industrial Waste Charges Established

The Buffalo Sewer Authority Sixth Annual Report for 1943-44 contains 73 printed pages beginning with an organizational chart of the Authority. A brief history of sewage disposal at Buffalo is included, from some 50 years ago when the "increase in number and severity of typhoid cases in the territory downstream from Buffalo" was observed down to the present day when "the Buffalo Sewer Authority is a major factor in the sanitation, cleanliness, and health of the Niagara Frontier."

In Buffalo, where 45 per cent of the revenue is raised by real estate assessment and 55 per cent through sewer rental, the average collection of rental charges was 94.3 per cent for the year.

Assessment of "special charges for treatment of industrial wastes of unduly high concentration, which cause increased treatment expense, has now become an established practice with the Authority. These special charges which are for the purpose of reimbursing the Authority only for the cost of chlorine consumption and for chemicals and power used for the disposal of solids in excess of normal sewage requirements, are determined from the adopted rate formula." (See *Water Works and Sewerage*, March 1944.)

Employing 15 persons in the administrative department, 127 in the sewage treatment plant and 82 in the sewer department, the Authority treats the sewage from 120,000 accounts, including some sewage from five areas outside the city limits by contract.

Part II, on the sewage treatment plant operation notes that the cost of operation (including pumping of all flow) was $8.23 per mil. gal. or $0.726 per capita. This is the highest cost of operation for any year and resulted not from costs of supplies, chemicals and power (actually less) but from "increases in salaries and a War Emergency bonus granted to all employees."

Pertinent operating data follow:

| Item | 1943-44 Avg. | 1942-43 Avg. | Six-year Avg. |
|---|---|---|---|
| Flow—mgd. ..... | 136 | 150 | 139 |
| Susp. Solids | | | |
| Raw—ppm. ..... | 207 | 205 | 190 |
| Effl.—ppm. ..... | 121 | 134 | 120 |
| B.O.D. | | | |
| Raw—ppm. ..... | 136 | 127 | 137 |
| Effl.—ppm. ..... | 101 | 101 | 108 |
| Chlor. Demand | | | |
| Raw—ppm. ..... | 5.0 | 4.76 | 4.9 |
| Chlor. Dose lb./da. | 4280 | 4900 | 5210 |
| Coliform Bact. | | | |
| Raw—1000/ml. .. | 105 | 68.4 | 69.8 |
| Effl.—1000/ml. .. | 2.18 | 1.42 | 1.45 |
| Sludge | | | |
| Raw—1000 lb./da. | 80.4 | 79.1 | 85.5 |
| Dig.—ditto ..... | 66 | 64 | 60 |
| Burned—ditto ... | 59 | 55 | 56 |
| Sludge conditioning | | | |
| CaO—lb./100 lb. . | 9.74 | 7.26 | 9.97 |
| $FeCl_3$—ditto .... | 2.05 | 1.94 | 2.43 |
| Gas—c.f./cap. .... | 0.79 | 0.73 | 0.77 |

Part III covers the operations of the sewer department. During the year 1017 sewer cleaning operations, involving 745,207 ft. of sewers, were conducted at a cost of 7.1 cents per foot. And 69,703 receivers or catch-basins were cleaned at a cost of 38.6 cents each.

## How Many Miles Will You Get Out of Your Truck?*

Nobody can tell off-hand, beforehand, or by sleight-of-hand how far a new truck is destined to travel before consignment to the junk pile or junk dealer.

So much depends upon truck care, that a strict mathematical determination of truck mileage is well nigh impossible. All that can be done is to build up an "average formula" based on actual average service under reasonably good conditions.

The accompanying chart is based upon such conditions. It gives the mileage that can be reasonably expected from a truck of any cost between $500 and $10,000, and any capacity between one and ten tons.

Simply lay a straightedge across the chart as indicated by the dotted line and Column C immediately gives the "expectant mileage."

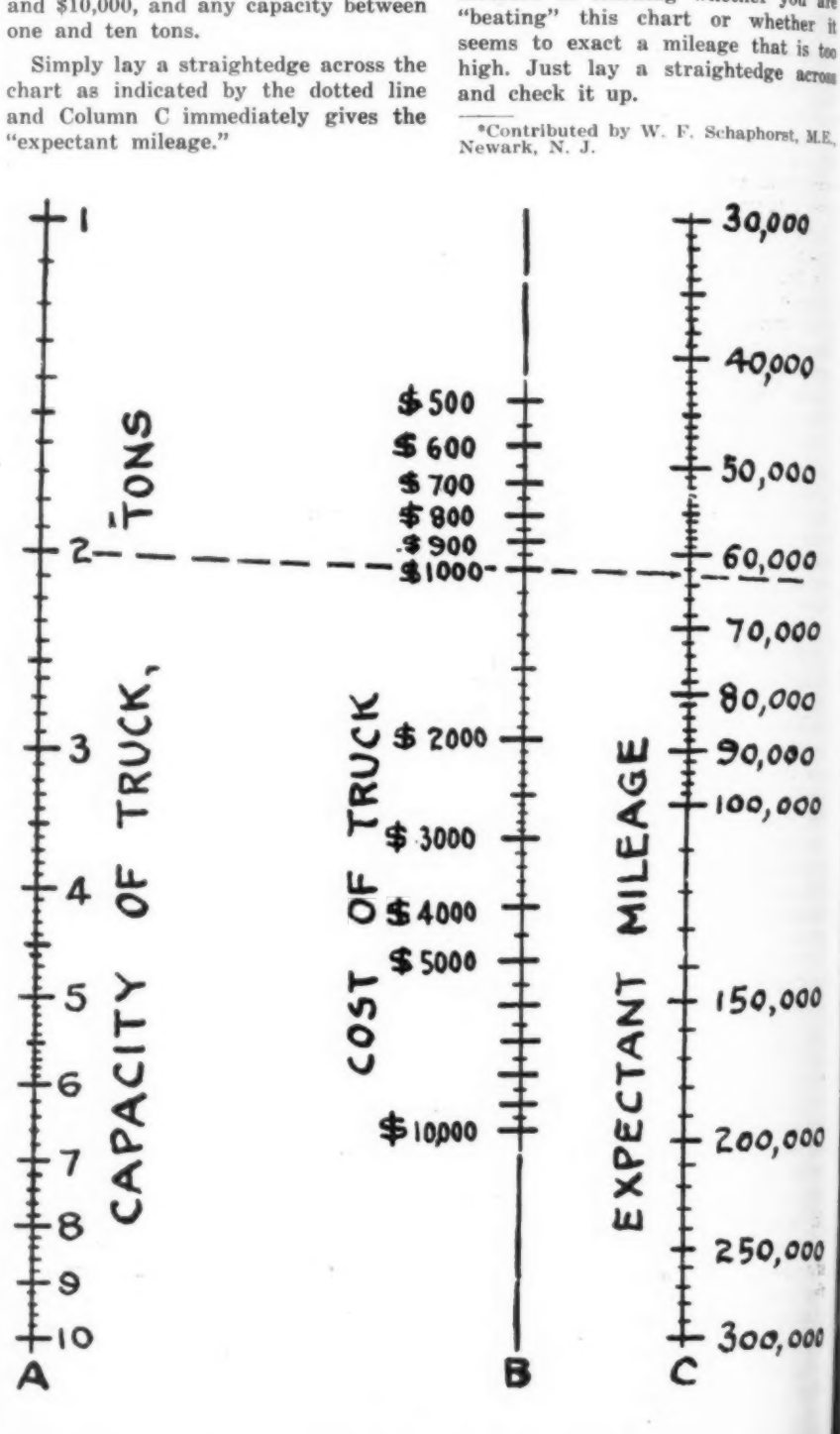
For example, what is the expectant mileage of a 2-ton truck costing $1000?

Connect the 2 (Column A) with the $1000 (Column B) and the answer is: "Nearly 63,000 miles"—Column C.

This chart is not based upon the "very best roads" or upon the "very best care." It should therefore be possible to get even more than 63,000 miles from a $1000, 2-ton truck, under the best of conditions. Under poor conditions such mileage cannot be expected, of course.

If you operate a truck you will be interested in learning whether you are "beating" this chart or whether it seems to exact a mileage that is too high. Just lay a straightedge across and check it up.

*Contributed by W. F. Schaphorst, M.E., Newark, N. J.



# IMPROVED RESIDUAL CHLORINE TEST*

## The Ortho-tolidine : Arsenite (OTA) Method for Testing Water for True, False and Chloramine Residuals

By F. W. GILCREAS
Division of Laboratories and Research,
New York State Department of Health
ALBANY, NEW YORK

THE reaction of free available chlorine with ortho-tolidine is practically an instantaneous one, requiring less than fifteen seconds for development of the color; thus the appearance of an immediate or flash color may be used as a measure of free chlorine present.

This flash color may be quantitatively estimated if a weak reducing agent such as sodium arsenite is added to the sample approximately fifteen seconds after the addition of the ortho-tolidine. (Step A) The sodium arsenite neutralizes all combined chlorine before it can react with the ortho-tolidine reagent. The flash color is not affected by the sodium arsenite reagent, but remains unchanged and may be read by comparison with permanent standards at any time within five minutes.[1]

When sodium arsenite is added first to the sample, (step B) all chlorine, both free and combined, is neutralized. Ortho-tolidine reagent added subsequently reacts with manganese and other interfering substances present, which are not affected by the sodium arsenite reagent, but which produce a color with ortho-tolidine similar to that indicating chlorine. This color may likewise be measured by comparison with chlorine standards.

Using readings obtained from these two procedures (steps A and B) and that of the standard ortho-tolidine test, it is possible to measure free available chlorine, combined chlorine, and ortho-tolidine color caused by interfering substances. The portion of sample to which ortho-tolidine reagent is added first, followed by the arsenite reagent, (step A) yields a color representing both free available chlorine and any interfering substances present. In the portion to which arsenite is added first, followed by ortho-tolidine reagent, (step B) the color produced represents interfering substances only. Thus, free available chlorine may be determined by subtracting the second value from the first. The false residual chlorine value is the second reading, (obtained in step B). If the reading of the first step is subtracted from that of the standard ortho-tolidine test for total chlorine, the residual chlorine value corresponding to combined chlorine or chloramine is obtained.

The determination of the free available chlorine, the combined chlorine, and the interfering substances may be facilitated by use of a technic employing the double-bottle method. Under routine operating conditions, however, it may be possible to dispense with this procedure and use only those determinations that are of most help in the control of chlorination in each particular plant. In any case the OTA test does not outmode present standard equipment for determining residual chlorine.

### Reagents[2]

*Ortho-tolidine reagent—method 1.* Dissolve 1.35 grams ortho-tolidine dihydrochloride in 500 ml. distilled water. Add this solution, with constant stirring, to 500 ml. dilute hydrochloric acid made by mixing 350 ml. distilled water and 150 ml. concentrated hydrochloric acid (sp. gr. 1.18-1.19).

*Ortho-tolidine reagent—method 2.* Grind 1 gram ortho-tolidine in a mortar with 5 ml. dilute hydrochloric acid made by adding 150 ml. concentrated hydrochloric acid (sp. gr. 1.18-1.19) to 350 ml. distilled water. Add 150-200 ml. of distilled water. The ortho-tolidine goes into solution immediately. Transfer the solution to a 1-liter graduate and add the balance (495 ml.) of the dilute acid and make up to 1 liter with distilled water.

*Storage of ortho-tolidine reagent.* Dispense this reagent in two-ounce French square brown glass bottles. Store in dark when not in use, and avoid exposure to low temperatures. The solution should be clear and colorless; discard it if it becomes either colored or turbid. Certain types of rubber stoppers are attacked by the strong acid and yield reducing substances that cause the reagent to deteriorate.

At temperatures below 0° C. the ortho-tolidine will precipitate from solution and will not redissolve readily. Any reagent containing a precipitate should not be used.

*Sodium arsenite reagent.* Dissolve 0.5 grams of sodium arsenite in distilled water and make up to 100 ml. Store in any sized bottle but use in a properly labeled 2-oz. French square reagent bottle with a screw cap medicine dropper.

### Permanent Chlorine Standards[2]

0.5 *M phosphate buffer solution.* Allow a sufficient quantity of disodium hydrogen ortho-phosphate dodecahydrate ($Na_2HPO_4 \cdot 12H_2O$) to dry over a saturated solution of potassium carbonate ($K_2CO_3 \cdot 2H_2O$) until the weight remains constant for one week, and weigh as $Na_2HPO_4 \cdot 2H_2O$. If disodium hydrogen ortho-phosphate anhydrate ($Na_2HPO_4$) is used, dry at 110° C. and cool in a desiccator.

Dissolve 28.66 grams disodium hydrogen ortho-phosphate dihydrate ($Na_2HPO_4 2H_2O$) (or 22.86 grams $Na_2HPO_4$) and 46.14 grams potassium dihydrogen ortho-phosphate anhydrate ($KH_2PO_4$) in 1 liter of distilled water. Let stand for at least several days before using, to allow time for formation of any precipitate, which must be filtered out prior to use.

0.1 *M phosphate buffer solution* (pH 6.45). Filter solution as prepared above and dilute 200 ml. to 1 liter with distilled water.

*Strong chromate-dichromate solution.* Dissolve 1.55 grams potassium dichromate ($K_2Cr_2O_7$) and 4.65 grams potassium chromate ($K_2CrO_4$) in 0.1 M phosphate buffer and dilute to 1 liter with the 0.1 M phosphate buffer. This solution represents 10.0 ppm. chlorine when viewed through a 240-300 mm. depth.

*Dilute chromate-dichromate solution.* Dissolve 0.155 grams potassium dichromate ($K_2Cr_2O_7$) and 0.465 grams potassium chromate ($K_2CrO_4$) in 0.1 M phosphate buffer and dilute to 1 liter with the O.1 M phosphate buffer. This solution may also be prepared by diluting 100 ml. strong chromate-dichromate solution to 1 liter with 0.1 M phosphate buffer. The solution represents 1 ppm. chlorine.

*Preparation of standards.* Measure the volumes of dilute chromate-dichromate solution given in Table I into clean two-ounce French square bottles of clear glass and dilute to exactly 50 ml. with the 0.1 M phosphate buffer solution.

TABLE I

**Chlorine Standards—Modified Scott Formula 0.05-1.0 ppm.**

| Chlorine Standards ppm. | Dilute chromate-dichromate solution ml. | Chlorine Standards ppm. | Dilute chromate-dichromate solution ml. |
|---|---|---|---|
| 0.05 | 2.5 | 0.40 | 20.0 |
| 0.10 | 5.0 | 0.50 | 25.0 |
| 0.15 | 7.5 | 0.60 | 30.0 |
| 0.20 | 10.0 | 0.70 | 35.0 |
| 0.25 | 12.5 | 0.80 | 40.0 |
| 0.30 | 15.0 | 1.00 | 50.0 |

The standards should be protected from contamination by dust by keeping the bottle closures tightly screwed down or by sealing the closure with collodion or paraffin. The standards must be stored in the dark and renewed if any trace of turbidity appears in them.

### Apparatus

1. Two-ounce French square bottles.
2. Medicine dropper caps to fit French square reagent bottles.
3. Commercial test kits may be used.

### Procedure for Ortho-tolidine-Arsenite (OTA) Test

1. Select three two-ounce French square bottles; mark one A, one B, and one OT.
2. Add 50 ml. of a sample of chlorinated water to each of the three bottles.
3. Unscrew, and fill droppers of both reagent bottles, one with ortho-tolidine, the other with arsenite.
4. Hold samples for the required period of contact, usually ten minutes, unless a period longer than that has elapsed between the application of the chlorine and collection of the sample.

*All operations noted in paragraph 5 should be carried out as rapidly as possible. For each bottle, the addition of reagents and mixing should be completed within ten to fifteen seconds.*

*This article is cited from material prepared by the author for use, in New York State, in connection with the OTA Test.

5. Add a dropperful of ortho-tolidine to bottle marked OT. Mix by one quick shake.
   Add a dropperful of ortho-tolidine to bottle marked A; mix.
   Add a dropperful of arsenite; mix.
   Add a dropperful of arsenite to bottle marked B; mix. Add a dropperful of ortho-tolidine; mix.
6. If the sample is cold, warm portion OT to 68° F. in a bath of warm water or by holding in the hand. Portions A and B do not require warming since the rate of color development is independent of the temperature.
7. Free available residual chlorine. Three minutes after addition of the ortho-tolidine, read portions A and B in comparison with color standards. Subtract the reading for B from that for A; the difference is the free available chlorine present.
8. False residual. Read portion B alone in comparison with color standards four minutes after addition of ortho-tolidine. If sample is colored or turbid use an untreated sample blank as in the standard ortho-tolidine test. This reading is due to interfering agents only.
9. Standard OT test. Read OT portion at four and one-half minutes in the usual manner.
10. Combined chlorine. Five minutes after addition of ortho-tolidine, read portions OT and A in comparison with color standards. Subtract the reading for A from that for OT; the difference is the combined chlorine (chloramine). If this reading exceeds 0.05 ppm., read again at fifteen minutes to allow for the slower development of color due to combined chlorine. Read portion OT again just prior to the fifteen-minute combined chlorine reading.
11. The following table gives the times and relations between the various readings.

| | Read at* | |
|---|---|---|
| A minus B | 3 minutes = | free chlorine |
| B | 4 minutes = | false residual |
| OT | 4½ & 14½ minutes = | total chlorine & false residual |
| OT minus A | 5 & 15 minutes = | combined chlorine |

*The combined chlorine reading must be made exactly at five minutes and at fifteen minutes because of the changing color. For the same reason it is essential to read B just after A minus B and to read OT just before OT minus A. The timing for the other readings is suggested for convenience.

### Procedure for Ortho-tolidine-Arsenite Test Using Commercial Test Kits

Four cells are necessary to perform the complete test. If only two are available, the test may be divided into two parts, the A and B portions and then the OT and A portions repeated. A large sample of water should be collected and both parts of the test carried out on the same sample. The procedure and the amounts of reagents are the same as for the test using 50-ml. portions in French square bottles. Because of the higher acid concentration present when the reagent is added to 15-ml. portions, it is not necessary to wait fifteen minutes for full color development due to combined chlorine; five minutes is sufficient.

### Limitations

Certain limitations in the technic are mentioned by Hallinan in his original publication of the ortho-tolidine-arsenite test.[1] In the test for chloramine, owing possibly to the incomplete reaction between arsenite and chloramine, the results may be 3.5 per cent low, an appreciable but not significant error. Products of the reaction of chlorine with organic matter, particularly amines, may also be included in the chloramine reading; thus, differentiation of chloramine from other forms of combined chlorine cannot be made.

The use of two reagents and the speed required in their addition have not been found to complicate the technic. In general practice, the technic has proven effective in the detection of interfering substances in an amount not greater than the equivalent of 1 ppm. of chlorine. As with all colorimetric methods, the precision of the test is governed by the limitations of color comparison, particularly in ranges of high color intensity. The test is effective in differentiating free available chlorine from that combined with ammonia or other forms of nitrogenous organic matter.

### Results of Application of the OTA Test

The test has been used routinely for a period of one month by the operators of 23 water supplies in New York State.[2] Of 659 days represented by the readings of these 23 supplies, a false residual was found on 102 days; and on 84 days the chloramine residual was 0.3 ppm. or less, with no active chlorine present. Three of the cooperating water supply operators reported definite false residual values repeatedly; and from these supplies samples of the water examined subsequently were found to contain significant amounts of manganese.

The results of this study indicated that the OTA test provides a quantitative estimation of the type of residual maintained in any given water, whether free available chlorine or the less bactericidal combined chlorine, and that it also provides a precise reading for the determination of substances which interfere with the ordinary ortho-tolidine technic. Thus, it has a definite application in the control of chlorination of water, particularly for those supplies in which such interfering substances may be continuously or intermittently present.

### References

1. Hallinan, F. J. Tests for active residual chlorine and chloramine in water. *Jour. Amer. Water Works Assoc.*, **36**, 296-302 (1944).
2. Committee on Control of Chlorination. American Water Works Ass'n Report, 1943. *Jour. Amer. Water Works Assoc.*, **33**, 1315-1328 (1943).
3. Gilcreas, F. W., and Hallinan, F. J. The practical use of the ortho-tolidine-arsenite test for residual chlorine. *Jour. Amer. Water Works Assoc.*, **36**, 1343-1348 (1944).

## Mark Owen Enters Consulting Firm

Mark B. Owen

Mark B. Owen, for the past year, Director of the ASCE Research and Development Committee, has resigned that position to become a partner on May 1st in the consulting engineering firm of Russell B. Moore Co., of 1456 No. Delaware St., Indianapolis, Ind.

In this new endeavor Mr. Owen will be associated with Mr. Moore, and Mr. G. E. Hines, and the firm will specialize in air fields, municipal power and light, water works, and sewage and refuse disposal.

As director of the ASCE Comm. of Post-War Construction, Mr. Owen developed a unique system of reporting the results of the running survey of proposed post-war developments, his latest report indicating approximately 6 billion dollars of planned construction in the water and sewage field, most of which is in twenty states.

Prior to his work with ASCE, Mr. Owen was associated with a New York firm in the design and sale of sewage and refuse equipment for several years, and before that he had been Commissioner of Public Works and Engineering of Dearborn, Mich. At one time he was also associated with Hubbell, Roth, and Clark, Consulting Engineers of Detroit.

## U. S. Civil Service Opportunities

The U. S. Civil Service Commission has announced opportunities in the fields of administration and personnel management for persons experienced in the management of public or private organizations.

There are no age limits but applicants must have at least three years' experience for the lowest salaried positions. Position Classifiers, Placement Officers, and Personnel Assistants ($3,163 to $6,228 a year) are needed, as well as Administrative and Executive Officers ($5,228 to $8,628) the latter especially for work in the disposal of surplus property and renegotiation of contracts.

Application Form 57 must be filed with the U. S. Civil Service Commission, Washington 25, D. C.

# CORROSION OF IRON BY SULFIDES

By
RICHARD POMEROY, Ph.D.
Montgomery and Pomeroy
Engineers and Chemists
PASADENA, CALIFORNIA

The Author

THE corrosion of iron by septic sewage, sludge, and waters containing sulfides has generally been considered a phenomenon of infrequent occurrence and of little practical importance. However, several examples of this sort of action have recently come to light, making it evident that the problem is serious enough to warrant more attention than it has previously received. This paper does not represent an exhaustive treatment of the subject, but is prepared in the hope that the presentation of a few typical cases of corrosion caused by sulfides may lead to a better understanding of the behavior of iron in such situations. Descriptions of the selected examples, based on observations, will be followed by a brief discussion of the principles and comments pertaining to suggested remedial measures.

## Corrosion by Waters Containing Sulfides

### *Septic Tanks*

Sulfides are usually present in septic tank effluents, and hence iron exposed to such effluents or immersed in septic tanks should show the extent to which iron is attacked by sulfides. That serious corrosion should be expected is shown by the following observations.

The first example is from La Jolla, Calif., where an 8-in. cast-iron pipe was used for an outfall to discharge effluent from a septic tank into the ocean. Breaking of the pipe by wave action after 13 years of service led to its abandonment. The inside of the pipe was then found to have a heavy coating of black material, varying in thickness from 1½-in. at the top to 3½-in. at the bottom, so that the diameter of the opening thru the 8-in. pipe was reduced to 3 inches (Fig. 1). Samples of the black material were found to have the following compositions:

| | I | II |
|---|---|---|
| Total iron | 41.6% | 43.7% |
| Total sulfur | 17.4% | 14.0% |
| Density | | 2.07 g/cc |
| Compounds probably present: | | |
| Iron oxide | 34% | .... |
| Ferrous sulfide, FeS | 8% | .... |
| Iron disulfide, $FeS_2$ | 28% | .... |
| Free sulfur* | 0 | .... |
| Moisture | 29% | 29% |
| Organic matter | 1% | .... |
| Acid-insoluble ash | 0.1% | .... |

Analysis of this material is complicated by the fact that when it is dried it oxidizes rapidly, becoming quite hot. If the material is treated with dilute hydrochloric acid (HCl), a portion dissolves readily. A further fraction dissolves slowly in more concentrated acid, but a final residue, grey in color, is not attacked even by hot concentrated HCl.

The insoluble residue, after extraction with carbon bisulphide ($CS_2$), was dissolved in aqua regia, and was found to contain iron and sulfur in the ratio 1. Fe : 2.12 S. It is evident that iron disulfide is present. (The excess sulfur may be due to incomplete solution of residual sulfur by the $CS_2$.)

It is assumed that the slowly soluble fraction was disulfide in a finely-divided relatively reactive state.

The excess of iron over sulfur in the whole material shows that not all iron is present as sulfide. It is assumed that oxide is also present, but the composition of the oxide is not known.

The exact proportion of the sulfides and oxide of iron are not known. The

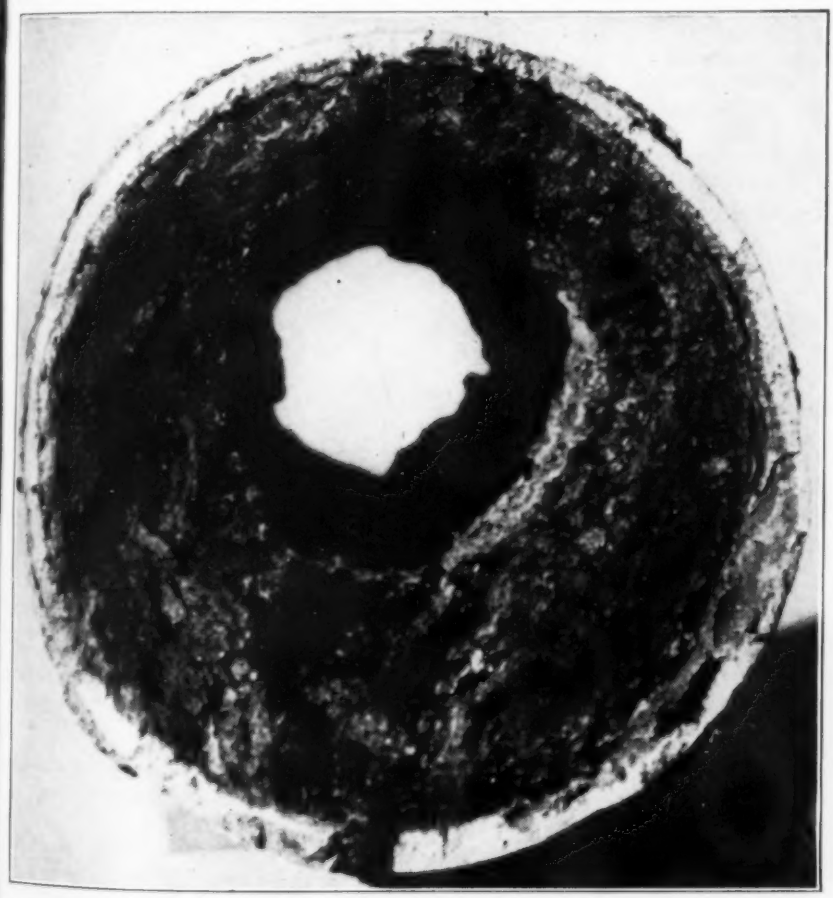


**Fig. 1. Eight-inch C. I. Pipe Outfall from Septic Tank after 13 Years**
*(Note accumulation of corrosion product and graphitic penetration of metal)*

*Free sulfur was tested for by washing a sample with alcohol, ether and carbon disulfide, but none was found. However in dissolving the corrosion product in acid some free sulphur is produced.

above result was calculated on the assumption that all free sulfur separating in the HCl treatment was due to disulfide.

The surprising bulkiness of the material (Fig. 1.) is correlated with the fact that the iron which went into its

**Fig. 2. Four-inch C. I. Effluent Pipe from Septic Tank after 6 Years**
*(Part of corrosion product has been removed by attempted cleaning)*

composition originally occupied a volume only one-ninth as great as the volume of the corrosion product. In other words, as the iron became corroded there was a nine fold increase in volume.

In spite of its bulkiness the material was hard enough so that its removal from a line would be difficult. Relatively high velocities of sewage flow did not suffice to keep the pipe clean, for the material had collected just as readily where the pipe was laid on a slope of 8 per cent, as where it was nearly level.

The metal of the pipe appeared to be very near its original thickness of 0.50-in. but observation of the fractured surfaces, as shown in Fig. 1, revealed a zone of darkening which had penetrated the metal to a depth varying from 0.06-in. to 0.32-in., averaging nearly a quarter of an inch. The material in this darkened zone had little of the original strength of the iron. This phenomenon, which is commonly referred to as "graphitization," will be discussed more fully in a subsequent section.

From a consideration of the factors which control sulfide generation, it is believed that the sulfide concentration in the sewage from this tank was usually between 2 and 10 ppm. A single test at noon on Sept. 26 showed 4 ppm., and a pH of 6.9.

The exposure of the pipe to sea water on the outside had led to spotted corrosion, mostly of the "graphitization" type, so that the ability of the pipe to withstand mechanical stresses had been greatly reduced and the pipe failed during an ocean storm.

A 4-in. cast-iron pipe had hung for six years in a vertical position in a septic tank at San Gabriel, Calif. Holes were eaten thru the pipe in places, and the shell of graphitized iron could be broken with the fingers. The deposit on the inside of this piece was about ⅜-in. thick, but the pipe had been cleaned a few months before, so that this does not represent six years' accumulation. On the outside of the pipe there was a thinner rather hard deposit of nearly pure corrosion product. Beneath this the pipe was smooth and looked like a piece of new iron but it could be cut with a knife, indicating that the iron had been dissolved leaving the graphitic structure only.

Beckwith[1] has published a photograph of another section of pipe from this same tank.

The horizontal run of pipe carrying the effluent from this septic tank was heavily coated on the inside with a deposit of sludge and iron sulfides (Fig. 2). Attempts to clean this section before the pipe was removed had only resulted in the cutting of an oblong opening through the deposit, with most of the cake remaining in place. As in the example from La Jolla, it is evident that the corrosion product occupied a volume many times as great as the volume of iron consumed.

A single test of the sewage in the septic tank showed 9 ppm. of sulfides and a pH of 6.0.

Fig. 3 shows a cast iron pipe which carried sewage from a septic tank serving an estate in Montecito, Calif. This pipe was examined after it had been exposed to the weather for several months, during which time the sulfides of iron had changed to hydrated ferric oxide, sulfur, and sulfate. Analysis of the material then found in the pipe showed the following composition:

| | |
|---|---|
| Acid Insoluble Matter | 1.60% |
| Iron Oxide ($Fe_2O_3$) | 62.00% |
| Calcium and Magnesium Oxides | 0.85% |
| Free Sulfur (S) | 17.77% |
| Sulfate Sulfur ($SO_3$) | 5.22% |
| Loss on Ignition (Less free sulfur) | 12.56% |

It is estimated that the original cake in the pipe (less moisture) was at least 90 per cent sulfides and hydrated oxides of iron.

A test of the sewage in this tank showed 60 ppm. of sulfides and a pH value of 6.9.

In 1930 the Masonic home at Decoto, Calif., installed an eight-inch cast iron pipe to carry the effluent from a septic tank. In 1940 this pipe was dug up to be re-used for a connection to the public sewer. When uncovered, it looked like new pipe, but the inspector hit it with a screw driver and pushed a hole thru it. The pipe was so full of corroded material that there was left only a two-inch space for the sewage to flow through. The presence of sulfides in the sewage was evident from the odor, and a flame test of the accumulation in the pipe gave the odor of burning sulfur, proving the presences of iron sulfide.*

### *Sewage in Treatment Plants*

Septic sewage is found not only in septic tanks, but also in many sewage collecting systems. If the corrosion of iron by sulfides is a general phenomenon, we should expect to observe sulfide corrosion in the case of unprotected iron in treatment plants where the sewage arrives in a septic condition, and this indeed is the case. The severity of attack increases as the sulfide concentration increases, and is more severe at low than at high pH values.

An example is afforded by the treatment plant at Salinas, Calif. When examined in 1941, after 12 years of service, the sludge collecting mechanism in the bottom of the primary clarifier showed rather deep penetration by corrosion, altho not yet approaching a serious condition. It is known that sulfides were present in the raw sewage, though information is not available as to actual concentrations. In contrast to this unit, the final clarifiers, handling the aerobic water from the activated sludge process, showed only slight superficial attack.

Over a seven-year period from 1931 to 1938 the sewage at another treatment plant contained an average of 0.65 ppm. of dissolved sulfides and had an average pH of 7.2. Some sulfide attack of iron structures occurred even with this low sulfide content. Cast iron surfaces were not seriously attacked, yet a coating containing sulfides built up to a thickness of ¼-in. in the seven year period. With 2-in. wrought-iron pipe the results were more serious, in part because the so-called wrought iron was attacked more rapidly than cast iron and in part because in pipe of this size less accumulation of corrosion product can be tolerated than in large-size cast-iron pipe. In three years of service sections of 2-in. pipe developed an internal

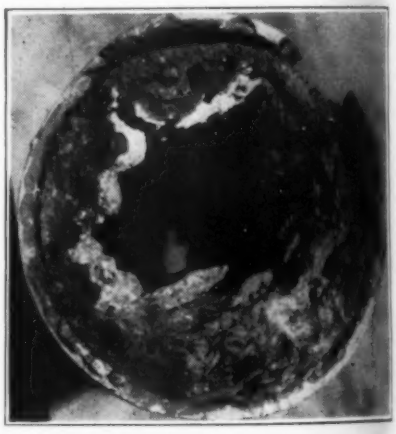


**Fig. 3. Effluent Pipe from Septic Tank after 4½ Years' Service**
*(Material filling the pipe was 90 per cent sulfides and oxides of iron)*

coating ¼ to ½ inch thick, so that replacements were required because of impaired capacity.

This sort of corrosion by septic sewage is doubtless familiar to many sewage plant operators and engineers. The two foregoing examples are merely selected as illustrative.

*Information furnished by Mr. R. E. Ramsler.

### *Sludge Digestion Tanks*

Regardless of the condition of the sewage coming into a plant, sulfides may be produced in the digestion tanks, in greater or less amount depending upon the relative concentrations of sulfate and of iron in the sewage. There are a number of digestion tanks in California in which corrosion difficulties have been observed. The most notable case, which is at the Terminal Island plant of the City of Los Angeles, was described in 1941 by Parkes[3] in *Water Works and Sewerage*. The sewage which is treated at that plant contains at times as much as 25 per cent sea water. No tests are reported for sulfides in the digester, but the high sulfate content of the sewage (because of the presence of sea water) would be expected to produce higher sulfide concentrations than in ordinary situations. The metal structures in the tank were chiefly steel or wrought iron. In 15 months manhole steps were nearly cut through by corrosion (Fig. 4). Leaks developed in the 2-in. iron pipe heating coils, and other structures showed similar attack. Mr. Parkes made electrical tests which clearly showed that electrolysis was factor. However, this does not preclude the possibility that sulfides may also have been a contributing factor of importance.

At Huntington Beach, wrought iron heating coils in the digester developed leaks after a year of service. A recent

**Fig. 5. Steel Pipe Corroded by Oil-Field Waste Water**

test for dissolved sulfides showed 12 ppm., but this cannot be relied on as an indication of average conditions. During the first year of use of this tank, before the digestion process had become stabilized, it is likely that sulfide concentrations were higher and that the pH was lower than during normal digestion.

At Newport Beach, Calif., where the sewage contains much sea water, and where the sludge therefore probably contains high sulfide concentrations, the blow-off line in the bottom of an Imhoff tank was attacked. The line was of cast iron with flanges held together by steel bolts. The bolts failed due to corrosion. The cast iron was also corroded, but not so seriously as the bolts.

**Fig. 4. Manhole Step from Inside Digester at Terminal Island**

The sewage at Laguna Beach, Calif., is normal domestic sewage. Three dissolved sulfide tests in the digester during 1940 showed concentrations from 7 to 9 ppm. The heating coils were of cast iron, but with wrought iron pipes entering and leaving the tank. Within four years the so-called wrought iron pipe developed leaks. The cast iron was also corroded, but not seriously.

Rowntree[3] reports another instance of corrosion of heating coils at Carmel, Calif., but information as to sulfide conditions is not available.

The digestion system of the Los Angeles County Sanitation Districts provides a case where sulfide concentrations were known to be low. The average dissolved sulfide concentration has been estimated to be 0.3 ppm. After eleven years of service metal structures showed only slight corrosion.

There are doubtless many sludge digestion tanks in which sulfide concentrations are high, and in which corrosion is in active progress. The fact that relatively few cases have been reported may be explained in part by the fact that most digestion tanks with complicated iron structures are less than twelve years old, and in part by the fact that in many situations there is little opportunity to observe the progress of corrosion until actual failures occur. But instances are being reported from various parts of the country with increasing frequency.

### *Other Sulfurous Liquids*

Sewage and sludge are not the only liquids which may contain dissolved sulfides. Oil-field waste waters sometimes develop sulfides, and unless the pH is quite high serious corrosion may result. A typical case is a welded steel pipe line 4-in. in diameter and 3800 ft. long, located in Santa Fe Springs, Calif. The water carried by the pipe shows about 10 ppm. of dissolved sulfides and a pH of 7.4. After 10 to 12 years of service the pipe is developing frequent leaks due to internal corrosion, particularly at the welded joints. Repairs are costing $250 per year.

Fig. 5 shows another example of sulfide corrosion by oil-field waste water.

A pump used during the construction of a tunnel handled ground water with sulfide concentrations ranging from 0 to 12 ppm., and with a pH of 7.4. Dissolved oxygen was also present. The cast-iron pump impeller (Fig. 6) fell to pieces in less than a year. The high velocities had scoured away the corrosion product and part of the graphitized iron, leading to more rapid attack than occurred on adjacent wrought iron pipes where velocities were lower.

Stumper[4] reports that cast iron pipe carrying water with 0.5 ppm. of hydrogen sulfide failed within three years.

## Corrosion by Soils Containing Sulfides

Sulfides are also produced in soils rich in sulfates and organic matter but largely devoid of oxygen. It is now recognized that sulfide corrosion of pipe lines in such soils is widespread and serious. This phenomenon is frequently referred to as "bacterial" corrosion, since bacteria are responsible for the production of sulfides. Hadley[5] reported extensive investigations of petroleum pipe lines in three eastern states, the results of which showed that of the total length of pipe which required protection against corrosion, 60 per cent could definitely be attributed to microbiological anaerobic corrosion. He

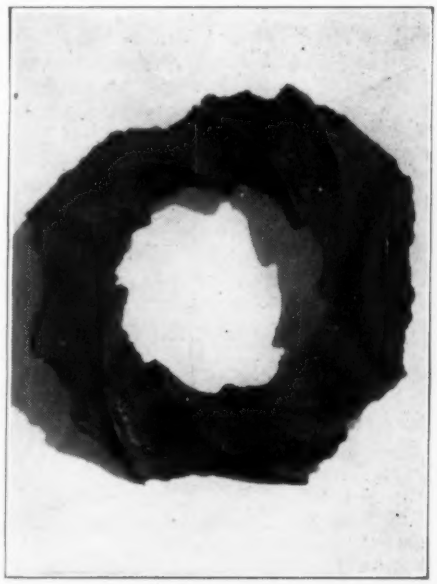


**Fig. 6. Remains of Centrifugal Pump Impeller after a Year of Service**

also presented data showing that sulfide corrosion proceeds at an accelerating rate, in contrast to rusting which progresses more slowly as the oxide layers increase in thickness.

## Corrosion by Gases Containing Sulfides

### *Rusting*

Unfortunately sulfides are not confined to the liquid where they are produced, but may escape as hydrogen

sulfide gas. The rusting of iron in pump stations, manholes, and other structures in proximity to septic sewage is too well-known to require further elaboration here. In most of these cases it is probable that a small amount of sulfuric acid, formed from hydrogen sulfide, accelerates the normal rusting action. In other cases an appreciable amount of iron may be dissolved directly by the sulfuric acid, forming a deposit of ferrous sulfate. This is illustrated by an instance from Santa Fe Springs, where there is a pipe line carrying oil-field water with a sulfide content of 2 to 5 ppm. and a pH of 7.8. At a manhole on this line where there happens to be considerable turbulence, there is also a slight positive air pressure, which carries some of the condensed moisture from the under side of the cover out thru the holes and cracks where the air escapes. When this condition was studied in January 1943, a rim of green ferrous sulfate crystals was found to be forming around these apertures, reaching a half inch in height. On dry days this effloresces to a white powder.

### *Corrosion with Production of Iron Sulfides*

Hydrogen sulfide gas may act directly on iron, without the preliminary oxidation to sulfuric acid. In this case a deposit of sulfides of iron will form, which may later oxidize with formation of ferrous sulfate, or it may accumulate as the sulfide. Since moist ferrous sulfide and disulfide are both oxidized quite readily by air, the accumulation of the sulfide above the water requires that it be protected from oxidation. This condition can be fulfilled if the surface supports an active slime growth of fungi and bacteria—a condition commonly found on the inside of sewers. When the sulfides of iron accumulate, they may lead to a condition more annoying than the slow destruction of the metal which would result from rusting—that is, the filling of the pipe with the voluminous corrosion product.

Fig. 7 shows the influent pipe to the septic tank on an estate at Montecito, Calif., after seven years of service. The condition is not yet serious, but shows graphitization of the cast iron which has progressed half way thru the pipe in places. This attack was caused by sulfide gas backing up the line from the septic tank or otherwise accumulating within the line which carried fresh sewage.

A four-inch cast-iron pipe leading to a septic tank was installed in 1919 on another estate at Montecito. In 1937 a stoppage occurred near the septic tank. A local plumber, who serviced the installation, reported a hard, black material on the inside of the pipe. An inspection made in September, 1940, showed the top of the pipe to be easily punctured with a pick. The bottom was fairly clean, but the top had a coating ¼ to ½-inch in thickness, consisting, apparently, of a mixture of iron sulfide and rust. The graphitization had penetrated to an average depth of about 0.03-in., but in spots the entire 0.16-in. of metal had been affected. No data could be obtained on the condition of the metal at the bottom of the pipe. The pipe was carrying fresh sewage, which, as expected, was found to be devoid of sulfides, so it seems likely that hydrogen sulfide gas was responsible. A test of the sewage in the tank showed 4 ppm. of sulfides and a pH of 7.5.

Hydrogen sulfide may come not only from septic tanks, but also from sewers, especially in warm climates in southwestern United States. House connections and plumbing may be damaged by gas from such sewers.

In several buildings in Tucson, Arizona, severe sulfide corrosion of the plumbing has been reported. An example of this is a hotel built in 1908. Leaks began to appear after about fifteen years. The attack has been most severe along the top of horizontal runs of pipe. Since a hole in the top of a horizontal run does not necessarily result in serious leakage, much of the pipe remained in place until the corrosion was far advanced, but replacement of several lengths thru the years has been required. An inspection in December 1940, showed that the three 4-in. connections from the basement to the sewer in the street were eaten thru along the top, and were nearly plugged with sludge and corrosion product, so that immediate replacement was necessary. The attack was most severe in the basement, but was observed even on the second floor. Fig. 8, a photograph of a section of 2-in. pipe taken from the second floor, shows penetration which produced a series of holes along the top. The bottom of the pipe was intact. The accumulation in the pipe contained iron sulfides and sulfur, proving that sulfides were a factor in the corrosion.

This striking example from Tucson apparently differs only in degree from a condition which evidently is very common. Corrosion of house connections in which sulfides probably played a part have been reported to me from San Diego and Santa Barbara. I have examined the plumbing in a number of old houses in various parts of Los Angeles, which were being demolished, and am of the opinion that sulfide corrosion of such plumbing, while not always serious, is almost invariably present. This is true even in areas where the sulfide concentrations in the public sewers have always been considered negligible. A representative case was a house being torn down after forty years of use. Pipes in the basement showed graphitic corrosion and were nearly filled with a deposit containing much iron oxide and sulfur, so that their usefulness must have been largely lost. This much corrosion in forty years may not be considered excessive, but it is a factor which should not be ignored in considering the economic consequences of sulfides in sewage. There is no doubt that in these cases the rate of attack of the metal, and the accumulation of corrosion product, was far greater because of the presence of $H_2S$ than it would have been in the absence of this corrosive factor.

The significance of sulfide corrosion as a cause of stoppages in house connections and plumbing has been largely overlooked in the past. This is probably because the graphitic nature of the attack of cast iron may leave the surface nearly unaffected, so that corrosion is not apparent, and because plumbers and others having an opportunity to observe such corrosion have not been on the lookout for it.

Where sulfide corrosion is suspected, simple tests will establish whether it is a factor. If the material on the surface of the pipe has not been dried, it may be treated with dilute hydrochloric or sulfuric acid, whereupon any iron sulfides which may be present will yield hydrogen sulfide, readily recognized by its odor. An alternative test is to dry a piece of the material, and then heat it in the flame of a match. The sulfides will oxidize with the formation of sulfur dioxide, which is also readily detected by the odor. If the material has been exposed to the air for some time before examination, the latter test should be used, for the iron sulfides may have changed entirely to iron oxide and sulfur. These tests are qualitative, and do not establish whether the sulfur compounds are present abundantly or sparingly, but if they are present at all the evidence may be considered quite strong that hydrogen sulfide or dissolved sulfides were important factors in the corrosion.

## Discussion of Principles

It is possible that iron may be corroded by sulfides with evolution of hydrogen, according to the reaction

$$Fe + H_2S \rightarrow FeS + H_2$$

It does not seem likely, however, that this reaction accounts for any considerable attack of iron, except when the pH is quite low. Laboratory experiments by the author, in which iron was immersed in sulfide solutions under strictly anaerobic conditions, showed corrosion rates too low to be of practical importance[6].

It is probable that corrosion as serious as that represented by the examples given in this paper usually depends on the presence of an oxidizing (depolarizing) agent. If oxygen plays this role, the reaction may be written

$$Fe + O + H_2S \rightarrow FeS + H_2O$$

It is not necessary for the oxygen to be present at the same location as the sulfide. If two pieces of iron are exposed respectively to waters containing sulfides and oxygen, and if there is a complete metallic circuit between them, then the above reaction will take place electrolytically or galvanically, with the resultant attack of the iron which is exposed to sulfides. This form of galvanic corrosion is very common.

A consideration of the circumstances prevailing in the reported instances of

corrosion by dissolved sulfides shows that in most cases oxygen may have been present simultaneously with the sulfides, either as air or in solution because of recent exposure of the liquid to air or because of leakage into pumps, or by air drawn into sewers through manholes. The exceptions are the sludge digestion tanks which have been described, and the primary digester at Salinas, Calif. In these units the conditions necessary for electrolysis are fulfilled, for the structures immersed in the septic fluid are in metallic contact with reinforcing steel and with other structures about the plant which are in an aerobic environment and usually grounded. Pipelines buried in moist soils frequently provide an excellent opportunity for external electrolytic or galvanic corrosion of this type.

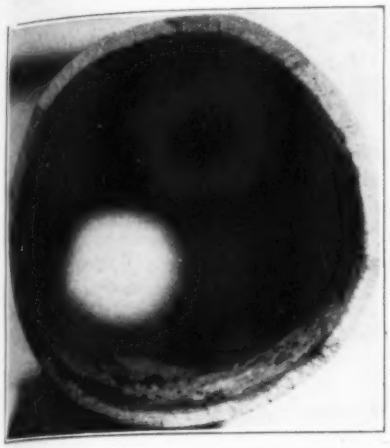


Fig. 7. Influent Pipe to Septic Tank
(*Note graphitization at left side*)

It is also possible for sulfate to serve as the oxidizing agent. Stephenson and Strickland[7] have shown that Microspira desulfuricans can bring about the reaction:

$$4\ H_2 + SO_4^{=} \rightarrow 4\ H_2O + S^{=}$$

If the corrosion of iron proceeds with the intermediate formation of hydrogen (a hypothesis), then the above reaction might account for depolarization of the metal surface by sulfate. But even if hydrogen is not an intermediary, oxidation-reduction enzymes of those bacteria instrumental in sulfate reduction might easily be able to take electrons from the iron and thus serve as intermediary oxidizing agents deriving their ultimate oxidizing capacity from sulfate. Bunker[8] has demonstrated rapid corrosion of iron by active Microspira desulfuricans cultures in the presence of sulfate, under conditions which make it quite clear that sulfate played the role of oxidizer. Bunker maintains, with strong substantiating evidence, that this is a major factor in the corrosion of pipe lines. Yet iron does not appear to corrode seriously in digesting sewage sludge except where there is the possibility of electrolysis involving outside cathodes. Parkes[2] found that the badly corroded rungs of iron steps in the digester were in electrical contact with the reinforcing steel, and that those rungs which did not have this contact were not corroded. The author[6] immersed iron in digesting sludge dosed with varying concentrations of sulfate, but found the corrosion rates to be very low in all cases. In the light of present knowledge it is not possible to state what conditions are favorable for sulfate to act as oxidizer.

When cast iron is corroded by sulfides, and by various other agents as well, the penetration is of the "graphitic" type. The nature of this change consists in removal of all or part of the iron, leaving behind graphite, carbides and silicides of iron, and other nonmetallic portions. This is brought about by a small-scale electrolytic process. Evidently the corrosion product is a fair conductor of electricity. The iron is dissolved at the front of the zone of graphitization, while oxygen is reduced at the surface of the corrosion product, or on other metal surfaces in electrical contact with the corroding iron. The pores of the graphitized material are filled with a dilute, acidic solution of ferrous salts, as may easily be demonstrated by tests. The ferrous ions diffuse back through the mass until they are precipitated as sulfides or carbonates by the soluble sulfides or alkaline substances in the water.

The mechanism of formation of iron disulfide, which involves further oxidation, has not yet been explored.

## Practical Considerations

From the examples given it is evident that the corrosion of iron by sulfides is not an exceptional occurrence, nor is it a matter of small economic importance. The question of greatest practical interest, of course, is what to do about it.

One method which suggests itself is the use of protective coatings. In the case of pipe lines in the soil, such coatings are of great value if durable and completely impervious to moisture. Heavy coatings of bituminous tar, together with wrappings of impregnated fabrics or sheets of water-resistant cellulose esters give excellent results. Tar base coatings are also often used for structures immersed in septic sewage, but it is difficult to attain permanence with such coatings, and periodic replacement may be necessary, often at considerable expense. If there is a chance for electrolysis, a coating with a few imperfections may be worse than none at all, for it may localize and concentrate the current and hence the attack, and may lead to more serious damage than if the action is distributed over a wide area. For protection of structures in sludge digestion tanks, coatings alone are of doubtful reliability.

On the inside of pipe lines cement linings provide the most effective protection, but they cannot be used for *partly filled* pipes carrying sulfide waters, because the production of sulfuric acid above the water causes disintegration of the cement. Acid-proof cements are sometimes used in these cases. More consideration should be given to the possible use of cement linings for other structures exposed to septic sewage.

Often the best procedure is to eliminate sulfides from the sewage. Several methods are now available to accomplish this; discussion of these techniques is beyond the scope of this paper.

Attention should be given to minimizing the iron structures in septic tanks and digesters. Where corrosion of the necessary structures occurs, it may be possible to make them easily replaceable, as has been done in the case of the digester heating coils at Laguna Beach and at Huntington Beach, California, and recently in other places.

Cathodic protection has been effectively used in the digestion tank at Terminal Island.[2]* That it has been successful in protection of pipe lines cannot be doubted, and it is certain that many of the lines where it has been employed were subject to sulfide corrosion. Inspections of the digester at Terminal Island have shown that corrosion has at least been greatly retarded.

Another method which may be used in the case of digestion tanks is to insulate the internal structures from metallic contact with re-inforcing steel or other structures about the plant, and thus prevent the flow of galvanic currents. This principle has been applied in one recent installation.

From what has been said previously, it is evident that pumps handling septic sewage should be designed to prevent the sucking of any air.

Ocean outfalls for the smaller sewage systems still offer a problem. These outfalls suffer not only from sulfide corrosion, but also from sea water corrosion and mechanical damage by the ocean. Protection may be provided by a thin cement lining on the inside, and a concrete jacket 1 to 2 inches thick on

Fig. 8. Two-inch Pipe from Hotel in Tuscon
(*Corrosion at top caused by hydrogen sulphide gas*)

*The reader is referred to the lead article in this issue revealing a very recent successful application of cathodic protection of metal parts in the sewage plant of Rutherford, N. J.—Editor.

the outside, with suitable reinforcement.

As for pipes in the collecting system, including house connections, it is of course desirable, insofar as possible, to use corrosion resistant materials.

Since damage to house plumbing may be caused by $H_2S$ gas escaping from the public sewer, it follows that sewer authorities have a responsibility to prevent this insofar as possible. Chemical control of sulfides will often be the answer. In some instances the maintenance of a slight negative pressure in the sewer atmosphere, by ventilation, may be practical. As a last resort, "house traps" may be necessary.

### *Summary*

Serious corrosion often occurs when iron is exposed to sewage and to other liquids containing dissolved sulfides, as is illustrated by several examples. The corrosion product is remarkably voluminous, yet hard enough to remain in place, and to cause stoppages in pipes.

Hydrogen sulfide gas is often carried by currents of air from sewers into house plumbing. It causes serious damage and stoppages, not only in the connections between houses and the public sewers where the connections are of iron, but also in waste lines within the buildings.

Theoretical considerations and remedial measures are discussed.

### *References*

[1]Beckwith, T. D. "The Bacterial Corrosion of Iron and Steel." *Jour. AWWA*, 33, 147-64 (1941).

[2]Parkes, G. A. "A Digester Corrosion Problem." *Water Wks. & S'wage.* 88, 99-105 (1941).

[3]Rowntree, Bernard. "Digester Corrosion Problem." *Water Wks. & S'wage.* 90, 421 (1943).

[4]Stumper, R. Reported by Speller, "Corrosion—Causes and Prevention," page 569. McGraw Hill, 1926.

[5]Hadley, Raymond F. "Methods of Studying Microbiological Anaerobic Corrosion of Pipe Lines." *Petroleum Engineer*, 11, No. 6, 171-76; No. 7, 112, 114, 116 (1940).

[6]Pomeroy, R. "Electrolytic Corrosion." *Calif. Sew. Works Jour.* 10, No. 2, 34-48 (1938).

[7]Stephenson, M., and Strickland, L. H. "The Reduction of Sulfate to Sulfide by Molecular Hydrogen." *Biochem J.*, 25, 215-20 (1931).

[8]Bunker, H. J. "Microbiological Experiments in Anaerobic Corrosion." *J. Soc. Chem. Ind.* 58, 93-100 (1939).

[9]Kozma, A. B. "Cathodic Protection Overcomes Operating Difficulties of Mechanical Sewage Filters." *Water Wks. & S'wage.* April 1945.

(No. 9 reference added by the editors, since the article had not been written when this paper was developed.)

## "Bill" Hurlbut Retires from Active Duty

**Has Long Served Los Angeles Water Bureau**

**Wm. W. Hurlbut**

Just as we are going to press news has been received of the retirement of W. W. ("Bill") Hurlbut from active duty as Chief Engineer and Deputy General Manager of the Los Angeles Bureau of Water.

Having reached the time for automatic retirement under the policy of the Los Angeles Dept. of Water and Power, Mr. Hurlbut follows his former chief, H. A. Van Norman, into retirement from active duty by less than a year. When Sam Morris was appointed General Manager of the Department of Water and Power as successor to Van Norman, an extension of the retirement date for Hurlbut was requested—this being ample evidence of the value of "Bill" Hurlbut to the Department.

Mr. Hurlbut is a past-president, an honorary member and Diven Medalist of AWWA and has long served the Association in various and valued capacities and is primarily responsible for the California section's sustained growth. He will continue active participation in this section and in AWWA.

## Thy Will Be Done

ROSCOE R. HOWARD.

Old Satan shows more worldly power
than ever since he fell:
His tyrants with their armies strive
to make this world a hell.

Satan has sponsored wars before,
yes, many times, but when
Has he employed such dreadful tools,
or half so many men?

The Japs and Germans fight to kill
the teachings of our Lord,
But when we fight for Freedom, we
defend His holy word.

The blood of innocents they slew
has cried out from the sod:
And they, as did Assyrian hosts,
shall feel the wrath of God.

Berlin, that modern Nineveh,
has felt the awful shock.
And Tokyo shall be ground to dust,
with bombs for every block.

We must drive on to victory:
we must not, will not fail:
For men, and nations too, must learn
that justice will prevail.

Our sons must fight to save the world
from pagan tyranny.
They fight that Satan may be chained,
and tortured peoples free.

We pray God for their safe return,
but say, "Thy will be done."
Lest we forget, to save the world
God gave His only Son.

Christ's birthday is approaching in
a world of hate and fear.
Now may His love and justice win
within the coming year.

The above verses, penned by Roscoe R. Howard, Sup't of Municipal Utilities, Slater, Mo., were actually written as Christmas greetings last year. We feel that the thoughts expressed are quite pertinent both to the Easter Season and to the time when the War's end approaches.

Our hats are off again to the "Bard" of the Missouri Water and Sewerage Conference, whom we consider to be a "poet of parts".

## Temporary Limitations to Steel Purchases Ordered by W.P.B.

Because of the shortage of steel during the second quarter, the WPB on March 28th, issued Direction 1 to P-141, limiting the amount of steel that an operator can order for delivery in the second quarter of 1945 to 80 per cent of the steel purchased under MRO authorization during the second quarter of 1944.

Unless circumstances demand otherwise this limitation will apply only in the second quarter. If an operator has already placed an order for more than 80 per cent of his 1944 allotment he must cancel same or reduce it. If it is absolutely necessary that an operator receive more than the 80 per cent allotment he may apply for relief from the direction immediately. If such application is made it must state why the steel is needed for MRO and why the amount cannot be reduced.

In the words of the order—

"This direction does not apply to any operator who will order for delivery less than 10 tons of carbon steel and less than 2 tons of alloy steel during the second quarter of 1945." Therefore, we hardly think it justified to print the Direction in full, since water and sewage works repair, maintenance and operation (MRO) will not require such quantities of steel for any single plant.

# A LUBRICATION CHECK SHEET

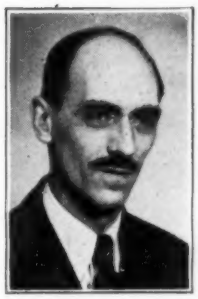
By

ROBERT C. URBAN

Sanitary Engineer

Corps of Engineers

WAR DEPARTMENT



The Author

DURING normal times, Joe Doe, operator of the Sewage Treatment Plant in Littleville, U.S.A., would be able to tell each and every one of the 50 to 100 lubrication points in his plant. For Joe had been operating the plant ever since it was built in the late thirties. Joe would also know when each lubrication point was last taken care of.

"But Joe's record was in his head—suppose he should leave."

"Why Joe would never leave—The sewage treatment plant is Joe's 'Baby.'"

But when the war came along Joe Doe was drafted and then Jack Jones took over, only to leave in six months, when Tom Smith tried it for a week and walked out—. You Mr. Sanitary Engineer, or City Engineer, or Superintendent, who in the final analysis are responsible for the plant, were faced with a special problem. A problem of double importance because of the war time responsibility of taking every precaution to conserve equipment and prevent breakdowns.

At that time a Lubrication Check Sheet would have been of importance and assistance to you in maintaining lubrication continuity in the face of adverse personnel conditions. If you didn't have one then and don't have one now, perhaps the one presented herewith will be of help to you. It is not just for war time operation. It will be of help in times of normal operation.

### *The First Step*

The first step in setting up a Lubrication Check Sheet is to locate every piece of equipment needing grease or oil as lubricant or protection.

"But," you say, "that just means to list the pumps and motors. That about covers it, doesn't it?"

"No, it is not as simple as it sounds. Don't forget the damper motor on your auxiliary hot water boiler and the motorized valve on your digester hot water line."

"Oh yes, those are motors, aren't they, and they must need lubricant."

"Right. And if either failed, trouble might result."

"Guess that about finishes it, doesn't it?"

"Not yet; what about those rotary ventilators?"

"We've got three of those; they spin like a top sometimes—must use some lubricant. Yes, there might be a time when, if they are able to spin like a top, they'll pull some very dangerous gasses out of the digester building."

"Yes, that's possible—And how about the spring on the flame trap?"

"Oh, those don't need any lubricant, they might never move in a lifetime, and I hope they never do."

"Okeh, but if they should, you'll want them ready to close and free from any corrosion that will prevent them from closing quickly, and all of the way."

"Never thought of that. Say, there are an odd assortment of things in a sewage treatment plant, that need lubrication for one reason or another, aren't there? And the funny thing is—of course, it's not really funny—if any of these units failed, considerable damage could result."

"That's right, and after you have finished your check sheet, you will probably pick up several more items in the course of the year."

### *The Second Step*

The next step is to use the manufacturer's maintenance instructions for each of the units that you have found need lubrication of some sort. Some manufacturers are not specific in their instructions, leaving out or vaguely describing the lubrication points and the recommended frequency of lubrication. This missing information you will have to obtain from other sources or "make a stab at."

For the kind of lubricants some manufacturers give a chart listing every lubricant manufactured and the specific type recommended for varying degrees of temperature, while others will tell you that they will not guarantee their equipment unless you use ZCO No. 621 Heavy Duty. If you feel it advisable to take such specific instructions seriously you will have to end up with several dozen different types of lubricants and as many grease guns.

If you do not want to go to this trouble you can call in a lubrication engineer from any of the recognized oil companies, who will prepare for you a Lubrication Specification Sheet covering every lubrication point you have listed. In this way you can cut down on the different types of lubricants you will have to stock—and in many cases just two different oils and two different greases will be sufficient to cover the majority of the equipment in the plant.

### *The Third Step*

You can now prepare the Lubrication Check Sheet. You now have a list of all units needing lubrication, the necessary lubrication points, the type of lubricant recommended for each point, and the recommended period of lubrication. The accompanying sample check sheet shows these items together with space for the date of each lubrication and the initials of the operator who performed the job. As indicated, it may be advisable to have a smaller chart for weekly check purposes, where more frequent attention is necessary.

Some check sheets will have to specify different lubricants for different temperature ranges. Columns may be added showing type of bearing and amount of lubricant to be used. Pack-

# SMALL SEWAGE TREATMENT PLANT
# MASTER LUBRICATION CHECK SHEET

1945

GREASE: "HEAVY" - X CO. NO. 2 HEAVY DUTY
"CUP" - X CO NO. 31 CUP GREASE

OIL: "20" - X CO. NO. 341 S.A.E. 20
"90" - X CO. GEAR OIL 90

| UNIT | FITTING TYPE | FITTING NO. | | TYPE OF OIL OR GREASE | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SEWAGE PUMP HOUSE | | | | | | | | | | | | | | | | |
| SEWAGE MOTORS (2) BEARINGS | PIN | 2 EA. | G | "HEAVY" | | | | | | | | | | | | |
| SEWAGE PUMPS (2) BEARINGS | PIN | 2 EA. | G | "HEAVY" | | | | | | | | | | | | |
| GREASE SEALS (2) | PRESSURE CUP | 1 EA. | G | "CUP" | ← | | CHECK DAILY & ADD AS REQUIRED | | | | | | | | | → |
| VACUUM MOTOR BEARINGS | PIN | 2 | G | "HEAVY" | | | | | | | | | | | | |
| VACUUM PUMP | SIGHT FEED | 1 | O | S.A.E. 10 | ← | | CHECK DAILY & ADD AS REQUIRED | | | | | | | | | → |
| FLOAT RODS (2) | "SURFACE" | 1 EA. | O | "20" | 2 T.M | 1 A.K | 5 J.M | 6 J.M | | | | | | | | |
| SCREENINGS GRINDER | | | | | | | | | | | | | | | | |
| GEAR REDUCER | PLUG | 1 | O | "20" | CHANGE 2 T.M | | | | CHANGE | | | | CHANGE | | | |
| (" ") | PLUG | 1 | O | "20" | CHECK WEEKLY & ADD AS REQUIRED - SEE WEEKLY CHECK SHEET | | | | | | | | | | | |
| LOWER SHAFT BEARING | PUSH | 1 | G | "HEAVY" | ← | | | TWELVE STROKES DAILY | | | | | | | | → |
| MOTOR BEARING | PIN | 1 | G | "HEAVY" | 2 T.M | | | | | | | | | | | |
| SLUDGE COLLECTOR | | | | | | | | | | | | | | | | |
| GEAR REDUCER | PLUG | 1 | O | "90" | CHANGE 8 T.M | | | | | | | CHANGE | | | | |
| (" ") | PLUG | 1 | O | "90" | CHECK WEEKLY & ADD AS REQUIRED - SEE WEEKLY CHECK SHEET | | | | | | | | | | | |
| SPROCKET BEARING | PUSH | 1 | G | "CUP" | GREASE WEEKLY | | | | | | | | SEE WEEKLY CHECK SHEET | | | |
| MOTOR BEARING | PLUG | 1 | G | MANUFACTURES SPECIAL | 8 T.M | | | | | | | | | | | |
| SLUDGE PUMP | | | | | | | | | | | | | | | | |
| MOTOR BEARINGS | PUSH | 2 | G | "HEAVY" | | | | | | | | | | | | |
| MAIN BEARINGS | PUSH | 4 | G | "HEAVY" | 8 T.M | 1 A.K | 5 J.M | 6 J.M | | | | | | | | |
| ECCENTRIC BEARING | SIGHT FEED | 1 | O | "20" | ← | | CHECK DAILY & ADD AS REQUIRED | | | | | | | | | → |
| CROSS HEAD BEARING | "SURFACE" | 1 | O | "20" | ← | | CHECK DAILY AND KEEP PIN COVERED | | | | | | | | | → |
| GEAR REDUCER | PLUG | 1 | O | "90" | CHANGE 9 T.M | | | | | | CHANGE | | | | | |
| (" ") | PLUG | 1 | O | "90" | CHECK WEEKLY & ADD AS REQUIRED - SEE WEEKLY CHECK SHEET | | | | | | | | | | | |
| CONNECTING ROD | GREASE CUP | 1 | G | "CUP" | ← | | | GIVE SLIGHT TURN DAILY | | | | | | | | → |
| TRICKLING FILTER | | | | | | | | | | | | | | | | |
| BEARINGS | PIN | 5 | G | "CUP" | 10 T.M | 6 A.K | 12 J.M | 13 J.M | | | | | | | | |
| ROTARY VENTILATORS (3) | | | | | | | | | | | | | | | | |
| TOP BEARING | "CUP" | 1 EA. | G | "CUP" | | | | | | | | | | | | |
| BOTTOM BEARING | "CUP" | 1 EA. | G | GRAPHITE MEDIUM | | | | | | | | | | | | |
| HOT WATER CIRCULATORS (2) | | | | | | | | | | | | | | | | |
| MOTOR BEARING | OIL CUP | 2 EA. | O | "20" | 2nd A.K | 1st J.M | 19 J.M | 20 J.M | | | | | | | | |
| SHAFT BEARING | GREASE CUP | 1 EA. | G | MANUFACTURES SPECIAL | 1st A.K | 1st J.M | 19 J.M | 20 J.M | | | | | | | | |
| FLOATING COVER | | | | | | | | | | | | | | | | |
| ROLLER (6) BEARINGS | PIN | 2 EA. | G | "CUP" | | | | | | | | | | | | |
| VALVES | | | | | | | | | | | | | | | | |
| 6" SCUM WELL PLUG VALVE | PLUG | 1 | G | PETROLEUM JELLY | ← | | KEEP VALVES TURNING EASILY | | | | | | | | | → |
| OTHER 6" PLUG VALVES | PLUG | 1 EA. | G | MANUFACTURES SPECIAL | ← | | KEEP VALVES TURNING EASILY | | | | | | | | | → |
| GAS LINE PLUG VALVES | PLUG | 1 EA. | G | MANUFACTURES SPECIAL | ← | | KEEP VALVES TURNING EASILY | | | | | | | | | → |
| WORM STEM VALVES | "SURFACE" | 1 EA. | G | "CUP" | ← | | KEEP STEM SURFACE COVERED | | | | | | | | | → |
| PRESSURE RELIEF F.T. UNITS | | | | | | | | | | | | | | | | |
| PRESSURE-VACUUM F.T. UNIT | LEATHER DIAPHRAM | 1 | O | NEATSFOOT | | 15 J.M | | 23 J.M | | | | | | | | |
| FLAME TRAP UNIT (SPRING) | "SURFACE" | 1 | G | "CUP" | | 15 J.M | | 23 J.M | | | | | | | | |
| PRESSURE F.T. UNIT | LEATHER DIAPHRAM | 1 | O | NEATSFOOT | | 15 J.M | | 23 J.M | | | | | | | | |
| (" ") (SPRING) | "SURFACE" | 1 | G | "CUP" | | 15 J.M | | 23 J.M | | | | | | | | |
| TELL-TALE | | | | | | | | | | | | | | | | |
| CHAIN | "SURFACE" | 1 | G | "CUP" | | 16 J.M | | 24 J.M | | | | | | | | |
| MOTORIZED VALVE | | | | | | | | | | | | | | | | |
| SLIDE | "SURFACE" | 1 | G | "CUP" | | | | 2 J.M | | | | | | | | |
| MOVING PARTS | BEARINGS | EA. | O | "90" | | | | 25 J.M | | | | | | | | |
| DAMPER MOTOR | | | | | | | | | | | | | | | | |
| MOTOR BEARING | "OIL CUP" | 1 | O | S.A.E. 10 | | J.M | | | | | | | | | | |
| CHLORINATOR | | | | | | | | | | | | | | | | |
| METAL | "SURFACE" | EA. | G | PETROLEUM JELLY | KEEP ALL METAL TUBING, VALVES, PARTS, ETC., COVERED. | | | | | | | | | | | |

**Suggested Lubrication Check Sheet**

*(Author's Note—This chart is presented solely for the purpose of illustrating this accompanying article, and is not intended in any way to show recommended lubrication specifications for the units indicated.)*

ing of ball bearings might be specified in cases where personnel are available to properly do that.

Time and experience will probably cause some changes in your original specifications of type of lubricant and period. There is no doubt, however, that as time progresses the Lubrication Check Sheet will become more and more important to the operation of the plant both as a guide to proper maintenance lubrication and as a record of it.

# SLUDGE BULKING CONTROLLED BY CHLORINATION

## Convincing Experiences with the Application of Chlorine to Return Activated Sludge at Army Plant

By STEPHEN R. KIN
Sanitary Engineer
CAMP BUTNER, N. C.

The Author

AT ONE of the Army Activated Sludge Sewage Treatment Plants in the South, chlorination of return activated sludge was tried to correct a condition of sludge bulking which persisted for several months.

Conditions for sludge bulking were favorable, i.e., summer season, heavy sewage loading and blower trouble. One of the three blowers had been down for repairs a considerable part of the time. However, even with all three blowers in operation, dissolved oxygen could not be maintained at the outlet end of the aeration tanks at all periods.

Corrective measures taken to control the sludge bulking included idling of one or more of the aeration tanks, with occasional additions of sewage for several days, and reducing the solids concentration in the mixed liquor. At one time, an effort was made to remove all of the activated sludge from the clarifiers and aeration tanks so that a new sludge could be built. Also, the by-passing of primary clarifier effluent to reduce the sewage load to the aeration units was tried. Some of the measures showed an improved sludge, but when this sludge was put into regular operation, it too began to swell.

### *Return Sludge Chlorination Last Resort*

Chlorination of the return sludge was started at a dosage of 10-16 PPM, based on return sludge flow. This high dosage, which appears even higher when the low suspended solids (700 PPM) of the return sludge is considered, was expected to destroy the filamentous growths. Whether or not all of the activated sludge was destroyed did not matter, since it was planned to build a new sludge after the chlorination. It was thought that the previous effort to grow a new sludge may have failed because all of the activated sludge, especially the filamentous growths, could not be completely removed.

After about four days of chlorination, the sludge lifted over the final weirs only during the peak flows. By the end of about ten days, the bulking was completely controlled, the final effluent was clear, and the sludge had good settling properties. This was unexpected. There proved to be no further need of "building up a new sludge" as had been expected and planned on.

Chlorination was continued for an additional ten days, although at a lower rate. During this time, no trouble was experienced in maintaining dissolved oxygen in the aeration tanks. Although during peak sewage loading while only two blowers were in use, the dissolved oxygen would often drop below 0.5 PPM.

After this chlorination, it was not too difficult to maintain the sludge in good condition. However, from time to time it was necessary to again practice chlorination of the return sludge until "threatened bulking" had been checked and a controlled sludge had again been reestablished.

---

## Penna. Sewage Works Operators Short School

### To Be Held on Seven Consecutive Wednesdays

Starting on April 11, and continuing for seven consecutive Wednesdays (terminating May 23) a short course will be offered for sewage treatment works operators at Saint Joseph's College, 54th and City Line Ave., Philadelphia, Penn.

This short school will be sponsored by the Pennsylvania Department of Health, Pennsylvania Sewage Works Association, Sewage Works Operators Association of Southeastern Pennsylvania, in cooperation with the United States Office of Education.

Subjects to be covered in the short school include: General Duties of the Operator and Reasons for Sewage Treatment; Characteristics of Sewage, Primary and Complete Sewage Treatment; Screens, Grit Chambers, and Sedimentation Units; Imhoff Tanks; Sludge Digestion; Sludge Drying, Gas Utilization, and Plant Hazards; Intermittent Sand Filters; Trickling Filters; Activated Sludge, Chlorination of Sewage; Chlorinators; Plant Records and Operating Reports; Effects of Industrial Wastes, and Mechanical Equipment. Laboratory sessions will also be given.

The faculty consists of George A. Elias, Dist. San. Engr., Penna. Dep't of Health; Harry J. Krum, City Chem. and Bact., Allentown, Penna.; and Gordor J. Wiest, Chem. and Bact., Penn. Salt Co. Guest lecturers include: H. E. Moses, Ch. Engr. Pa. Dep't of Health; Dr. Harry W. Gehm, Tech. Advisor, National Council for Stream Improvement; Linn H. Enslow, Editor, *Water Works and Sewerage;* W. Allen Darby, East. Mgr., The Dorr Co.; P. N. Daniels, Trenton, N. J.; L. L. Langford, East. Mgr. Pacific Flush Tank Co.; L. W. Van Kleeck, San. Engr. Conn. Dep't of Health; Frank E. Daniels, Ch. Chem., Penn. Dep't of Health; Frank Woodbury Jones, Partner, Havens and Emerson, Cons. Engrs.; Dr. Gail P. Edwards, Prin. San. Chem., Dep't of Pub. Works, New York City; A. E. Griffin, Ass't Dir. Tech. Serv. Div., Wallace and Tiernan; L. S. Morgan, Dist. Engr., Penn. Dep't of Health; Christian L. Siebert, Exec. Engr., Penn. Dep't of Health; and Stanley E. Kappe, Chicago Pump Co.

# The Editor's Comments

## A Shining Silver Anniversary

LAST year in these columns we commented at some length on what we termed the "Clicking Canadian Section." It constituted an attempt at giving the glowing impressions left on this writer, who had recently attended the 24th annual meeting of the AWWA's. Canadian section, where he had an opportunity of seeing it function so effectively, so smoothly. As an observer in the "front-office," so to speak, it was impressive—but, when privileged to look in on the behind-the-scenes functioning of the section what was revealed became even more impressive.

Last month we again had the opportunity of seeing the Canadian Section in action during its silver anniversary meeting in Toronto, as recorded elsewhere in this issue. This time we saw it click to the tune of a paid registration of 800 for the meeting, as contrasted to the previous record registration of 555 for the 1944 meeting which presaged the success of the 1945 meeting. Again this year, too, we were privileged to look in on the behind-the-scenes operations. Last year we expressed the opinion that by far the major reason for the clicking of the Canadian Section was just one man —Secretary Berry. This year we can say that this opinion was further confirmed in what we saw, and what we learned through conversation with present and past officers of the Section. And, more particularly, through observing what transpires during the past chairman's luncheon, attended by former chairmen and the present officers of the Section.

The reason for these luncheons is to give those attending an opportunity to express opinions concerning annual meeting arrangements, the technical programs, the policy of the Section executive and future Section activities. In this meeting frank criticism is invited and secured, opinions are voiced, suggestions made, and voted on. The secretary propounds a formidable number of questions to force out opinions, likes, dislikes, suggestions.

We learned too that the manufacturers have representation at these luncheons of past-chairmen and the current executive. Members of the executive of the Canadian Water and Sewerage Works Equipment Association are invited to attend and give voice to their opinions likewise. Out of this comes harmony and mutual regard which is impressive. No hint of selfishness showed itself in any quarter. The equipment representatives respond to every request or suggestion, and the result is seen throughout the annual meeting.

In the latter category we cannot leave this subject without commenting again on the type of entertainment provided by the Canadian Equipment Association and in particular the "Water Works Club Room"—an innovation a few years back which has now become an established success. It started as an "experiment," in an attempt to do away with the evils of individual entertaining in hotel rooms. The Equipment Association and the Section's executive jointly decided on a trial of the "Club Room" idea, where members of the Equipment Association would collectively entertain—serving liquid refreshments and providing music during prescribed hours. That is, the "Club" is open only during hours when there are no meetings or other program activities of the Section under way. The rules have been adhered to, the "Club" is well managed under the eyes of the Equipment Association Executive, and the flow of beverages is well regulated to avoid abuse by the few who are found in any group having free access to the flowing-bowl. The scheme is a success for which the laurels go to Messrs. George Morgan and Jim Kinney, as president and secretary of the Equipment Association, and to the members of their club committee.

The secret of the success of the "Club" scheme is all in how the enterprise is run and managed.

## 70 Years Young!

EVER so often a letter reaches the desk of an editor which makes him feel that there is some justification after all for burning the midnight oil. We want to tell you of a cherished example.

Like any other magazine our Circulation Department sometimes finds renewal of subscriptions slow. This brings forth a special letter of appeal to the subscriber who appears to be wondering whether he is getting value received from *Water Works and Sewerage*. Frequently we get letters of explanation along with the late renewals—sometimes just the letter. None of these letters received recently has given us the pleasure and reassurance that have the following comments from a small town water superintendent—M. G. Smith of Thomas, W. Va.—who states:

" I have learned a lot from your *Water Works and Sewerage* magazine, and I have taken it for a number of years. I will be 70 years old soon, and with buying of bonds, deductions from salary, and the cost of living what it is, there is not much left from the salary that a small town of this size pays.

"At first it seemed that it would not be possible for me to spare the money, taking everything into consideration. At the same time I can hardly see how I could do without your magazine, as there have always been new things coming up in it that were very beneficial.

"I have held this place since 1927, and hold a certificate of operation from the State Health Department. Have had my certificates renewed by examination from year to year. In this examination I have found your magazine to be of much help, as well as contributing many helpful hints and suggestions that can be applied to a small town plant such as we have here in Thomas. One suggestion alone was worth about $40.00 to the Water Department of this mountain city."

We thereupon wrote Mr. Smith that there was only one thing wrong with his letter explaining why he was late renewing. To his statement about soon being 70 years old we replied that this editor appreciated his letter most highly but we would argue the age matter with *any* person of his sincerity of purpose and awakeness to improved methods and new ideas. What we said further was that we had rather sell *one* subscription to a man 70 years young than a half dozen to some who fail to get from *Water Works and Sewerage* what is there for them.

We sincerely meant what we said to Mr. Smith. Our never-ceasing wish is that there might be some method through which we could declare the subscription bill to *Water Works and Sewerage* a "lien" on the small town Water or Sewer dept. What we mean is this: Why should the Smith's of the Thomasvilles be expected to pay two bucks from their thin take-home pay while saving the Department forty bucks? Doesn't a technical magazine in the final analysis belong under the classification "tool of the trade"? We think it does!

L. H. Enslow

# MEETINGS SCHEDULED:

**IMPORTANT**

It will be noted that a number of the conferences listed below have been cancelled as the result of the directive issued by the Federal War Committee on Conventions.

Meetings, conferences, short schools, which will require hotel rooms or sleeping car accommodations for no more than 50 persons are considered as local or sectional meetings, and a permit to hold such meetings is not required. Therefore many conferences and short schools can be held without filing an application. Note the NEWWA and Maine meetings reported in last month, as examples. Also note that the Canadian Section met last month, as reported in this issue.

Apr. 11—May 23 (Seven Weekly Sessions) PHILADELPHIA, PA. (St. Joseph's College).
**Penna. Sewage Works Operators' Short School.** Francis S. Friel, 1520 Locust St., Philadelphia, Pa., Director of School.
(Seven sessions to be held on consecutive Wednesdays, begin Apr. 11 and run through May 23.

Apr. 12-13—LEWISTON, MONT. (Hotel Burke).
**Montana Sewage Works Ass'n** (First Annual Meeting). Sec'y-Treas., Herbert B. Foote, State Board of Health, Helena, Mont.

Apr. 13-14—LEWISTON, MONT. (Hotel Burke).
**Montana Section A.W.W.A. Sec'y, H. B. Foote, Dir. Div. San. Eng., State Board of Health, Helena, Mont.**

Apr. 19-20—ELMIRA, N. Y.
**New York Section A.W.W.A.** (Cancelled)

Apr. 28—KENMORE, N. Y. (Kenmore Y.W.C.A. Building).
**Western Section, N.Y.S.S.W.A.** Secy, Channel Samson, 176 Midland Ave., Kenmore, N. Y.

May 2—BOSTON, MASS. (Statler Hotel).
**New England Sewage Works Ass'n** (Spring Meeting). Sec'y-Treas., LeRoy W. VanKleeck, State Dept. of Health, Hartford, Conn. (In our Feb. issue erroneously marked "Indefinitely postponed.")

May 7-11—ST. LOUIS, MO.
**American Water Works Ass'n.** (Annual Conference Cancelled). However, there will be held a meeting of the Board of Directors for the purpose of transacting the essential business of the Association at some centrally located point—the place and date to be announced later.—Ed.

May 18-19—GEARHEART, OREGON (Gearhart Hotel).
**Pacific Northwest Section A.W.W.A. Sec'y, Fred Merryfield, Oregon State College, Corvallis, Ore.**

May 23—NEW YORK CITY, N. Y. (Tallmans Island Plant).
**Long Island Section, N.Y.S.S.W.A.** Sec'y-Treas., C. George Andersen, P. O. Box 174, Rockville Centre, N. Y.

June 8—(Meeting place announced later)
**New Jersey Section A.W.W.A.** (Spring Meeting) Sec'y, C. B. Tygert, Box 178, Newark, N. J.

Sept. ——TORONTO, ONT. (Date and hotel later.)
**Federation of Sewage Works Ass'ns.** (Annual Conference.) Exec. Sec'y, H. W. Wisely, 325 Illinois Bldg., Champaign, Ill. (Application to hold has been filed with War Convention Committee, Washington).

MORE THAN DOUBLE PUMP LIFE

Building sustained efficiency into the mechanical structure of a pump was a problem solved by Peerless engineers.

Peerless engineering is *precision engineering* that permits *closer tolerances* which eliminate the customary vibration to an unusual degree. Thus, wear and tear are reduced; repair bills consequently are the lowest known.

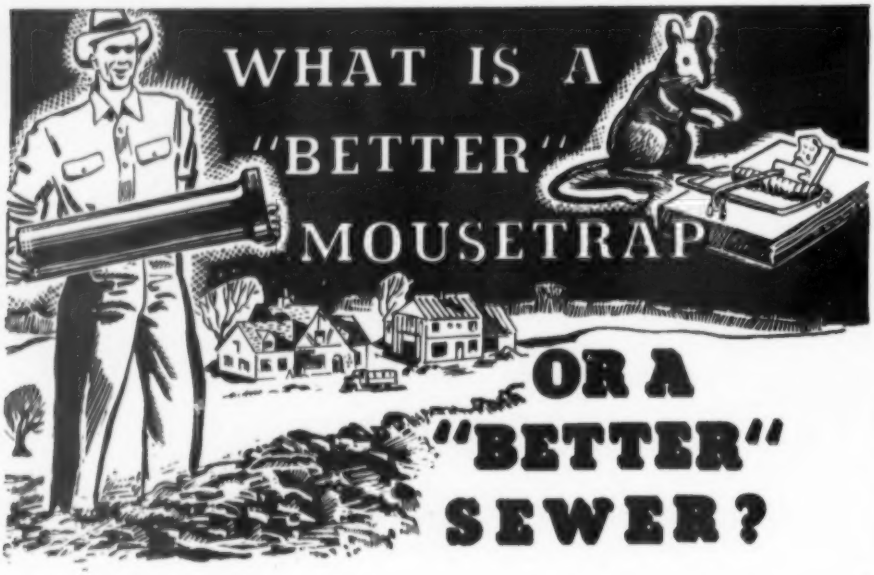
The most vital parts of a Peerless Pump are *doubly* protected . . . by a *Double Seal* and *Double Bearnigs* . . . plus rugged construction . . . that more than double the productive life of the pump.

*"Torture-chamber"* tests in the Peerless hydro-mechanical laboratory disclose that the Peerless-featured, fully-enclosed impellers are little affected by sand-cutting and cavitation.

*Capacities—10 to 220,000 gallons per minute*

Peerless Distributors and Direct Factory Representatives are located in every State

PEERLESS PUMPS
PEERLESS PUMP DIVISION
Food Machinery Corporation
TURBINE
HI-LIFT
HYDRO-FOIL
301 W. Ave. 26, Los Angeles 31, Calif. • 1250 Camden Ave. S.W., Canton 6, Ohio • Other Factories: San Jose 5, Fresno 16, Calif.




# OR A "BETTER" SEWER?

MAN has long talked about a "better" mousetrap. Just what would a "better" mousetrap be? A "better" mousetrap is one which would catch more mice more surely, over a long period of time without costing too-much-per-mouse caught.

A better sewer, or any other kind of drain, is one which will do the job best, over the longest period of time at the lowest cost. Low *first* cost doesn't mean a thing, if the sewer or drain will not stand up in long service.

*Vitrified Clay Pipe* is the finest material available for carrying any kind of sewage or drain water. It is both CHEMICAL-PROOF and ABRASION-PROOF. It is economical, strong and easy to install.

*Vitrified Clay Pipe Will Not* CORRODE, DECOMPOSE OR CRUMBLE through the action of acids, alkalies, industrial wastes, gases or the grinding abrasion of sand and gravel moving in water.

Engineers and builders who must consider the sewerage or drainage problems in the construction of highways, streets, airports, railroads, public buildings, factories and homes cannot find a better "underground" material where long life and long-run economy are concerned.

When *final* cost, as well as first cost, is fully considered, you will find: "IT WILL PAY TO USE CLAY."

**WRITE FOR INFORMATION**

Through its technical engineering staffs, the Clay Pipe Industry carries on constant research to improve products and to adapt them to current construction practices. For latest information or engineering literature, write to:

**NATIONAL CLAY PIPE MFRS., Inc.**
**111 W. WASHINGTON ST.**
**CHICAGO 2, ILLINOIS**

C-1244-18

**SPECIFY CLAY PIPE**


# Here and There with Doc Symons

While visiting Chicago not long ago, I ran into an old college chum, who, when he learned of my present work, said, "So you're an editor now, O.K. write me a five-word editorial." That was easy, in fact it was done in four words, "I don't like Spinach." Of course that's only a headline for an editorial on life, politics, statesmanship, international affairs, sportsmanship, or what have you, but it served its purpose and my erstwhile college chum changed his facetious tone and inquired as to just what an editor does.

Now I don't know what others do, but when I receive a typescript sin-


**PITTSBURGH IMO METERS**

**SCREW PROPULSION TYPE**

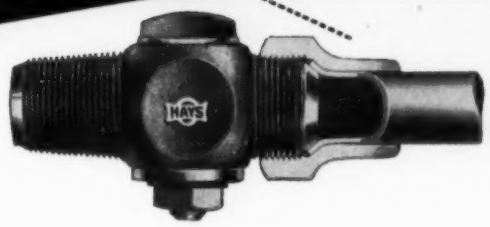
This *exclusive* all-rotating design combines the maximum in low flow accuracy and sustained accuracy with silent operation, long life, and a minimum of maintenance. Made in sizes ⅝", ⅝ x ¾", and 1".

**Pittsburgh Equitable Meter Co.**
**Pittsburgh 8, Penna.**

SEVENTY-SIX YEARS
HAYS
DEPENDABLE SERVICE

# COPPER SERVICE METHOD

*Assures* { SIMPLICITY / SAFETY / ECONOMY




**1-Accepted Water Works Standard Threading Permits Use in Any Standard Tapping Machine**

**2-Interchangeable With All Other Makes**

HAYS, a pioneer in the development of copper pipe services, has a complete line of stops and fittings for use with copper pipe. The use of copper pipe and Hays Radius Seal Joints eliminates much labor in installation. It simplifies the making of tight, leak-proof connections which, together with its long functional life, provides the utmost in economy

Illustration shows a Hays Corporation Stop with Hays Radius Seal Joint. This popular joint features a 45° machined seat and pipe flare and is available directly on Hays Corporation and Curb Stops, Service Connections, Goosenecks, Branches, Adapters, Stops and Drains, etc. Each Hays fitting is hydrostatically tested at 200 pounds or more; is uniformly accurate in every dimension. Hays Water Service Brass Goods Catalog shows illustrations and gives full descriptions. Send for your copy

BE SURE TO REPLACE WITH ANOTHER HAYS STOP

SEVENTY-SIX YEARS HAYS DEPENDABLE SERVICE

COPPER · BRASS · LEAD IRON
**WATER WORKS PRODUCTS**
**HAYS MANUFACTURING CO., ERIE, PA.**

*Buy More War Bonds*

# The key to the city's health and happiness is soft sparkling water!

Yes, water is easily the most important of any community's public utilities. That's why its *quality* is so important.

Thousands of people in the homes, shops and factories of modern municipalities already enjoy soft, sparkling water from every faucet. Officials of these cities installed Permutit* Water Conditioning equipment—and thereby gained the everlasting gratitude of their citizens.

Put this essential, postwar improvement at the head of *your* list—it's necessary to your city's happiness and progress.

Get the facts about Permutit's economical equipment *right now*. Write to the Permutit Company, Dept. G1, 330 West 42nd Street, New York 18, N. Y., or Permutit Company of Canada, Ltd., Montreal.

*Trademark Reg. U. S. Pat. Off.

**PERMUTIT**

WATER CONDITIONING HEADQUARTERS

CLAYTON FOR THE TOUGH JOBS!

Do you have a problem involving pressure control in 2" to 16" lines carrying water, oil or gas? Does that problem involve a wide drop in pressure—or is it within critical limits of only a few inches of water?

CLAYTON Pressure Reducing Valves may be the answer. Shown above is an installation of 5 Clayton Pressure Reducing Valves on 16" lines which handle a pressure drop from 280 lbs. PSI to 160 lbs. PSI. In other installations, Clayton 16" Pressure Reducing Valves are handling reductions as limited as from 9 inches to 4 inches of water.

*Write for Clayton Recommendations to fit Your Requirements. Representatives in Principal Cities.*

VALVE DIVISION
CLAYTON
"Feather Touch" CONTROL

CLAYTON MANUFACTURING COMPANY, ALHAMBRA, CALIFORNIA

gle spaced, I swear—softly, of course. Then I read it, putting in sub-headings which the author has generally left out; and I change P.P.M. or p.p.m. to ppm., and c.f.s. to cfs., and g.p.m. to gpm. and m.g.d. to mgd., and m.g. to mil. gal., and % to per cent, and 6'4" to 6 ft. 4 in., and 4" pipe to 4-in. pipe, all in accordance with the A.S.A. system of style for abbreviations.

If I find a sentence beginning with "however," I usually move it, the "however," somewhere into the middle of said sentence; or if a sentence begins with "He," I usually try to find out who "he" is; or when a sentence begins with "this," I try to ascertain what "this" refers to and revise it, so the reader will know too; and when the author gets lost in a *which* clause, I try to dig him out.

Well, there you have a few of my editorial idiosyncracies, in case you, like my friend, have been wondering.

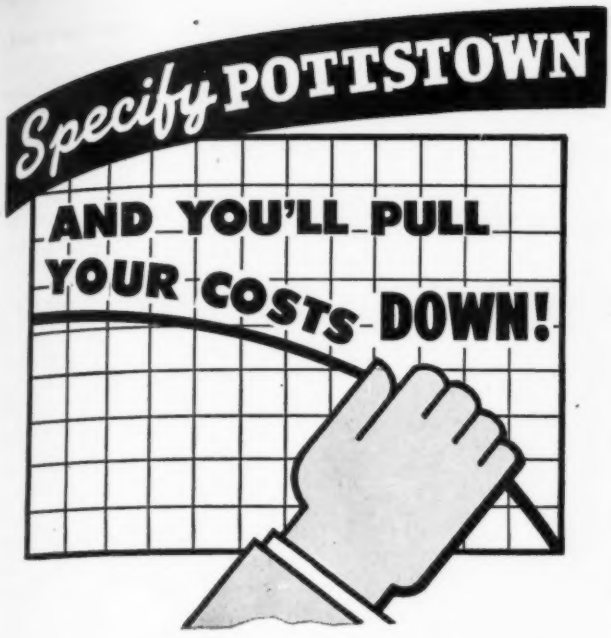
* * *

It wasn't enough that ODT decreed the cancellation of Water and Sewage meetings, thereby depriving me of a chance to pick up material for this column, but another little item has come up to ruffle the calm

'BESTOLIFE
LEAD SEAL
JOINT SEALING
AND ANTI-SEIZE
PIPE JOINT COMPOUNDS

'BESTOLIFE Compounds have been used successfully for years in Water Works and Sewerage plants.
They obtain their effective anti-corrosion sealing characteristics from the metallic lead base of the compounds.
Use 'BESTOLIFE Compounds on water, oil, gas and gasoline lines; all threaded connections in valves, hydrants, pumps, engines, air compressors, etc., and on all studs and bolts. Also recommended for meter repairing.

Manufactured Exclusively By
I. H. GRANCELL
MIRAMONTE AND EAST NADEAU ST.
LOS ANGELES 1, CALIFORNIA
EXPORT: THE NATIONAL SUPPLY CORP.

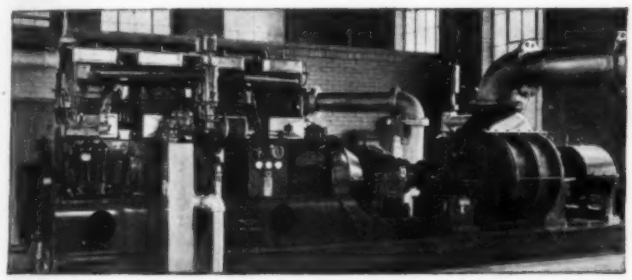



## AIR BLOWERS for Sludge Aeration

To prevent clogging of diffusers, avoid blowers that require internal lubrication. POTTSTOWN Rotary Blowers are extensively used in sewage plants because they require no internal lubrication—cannot contaminate the clean air pumped to your filters or diffusers.

Inasmuch as the two impellers in these positive displacement POTTSTOWN Blowers do not touch each other, nor even the casing wall interior, there is *no surface friction*—no need for internal lubrication. No wearing parts here, so your operating and maintenance *costs are DOWN—with POTTSTOWN!*

Pottstown Rotary Blower with Sludge Gas Engine drive. Also available with Electric Motor, Belt, Steam Turbine, and Diesel Engine drives.



## GAS EXHAUSTERS for Sludge Digestion

To prevent explosions of sludge gas, avoid its accumulation and possible mixture with air under digestion tank-tops. POTTSTOWN EXHAUSTERS syphon the sludge gas from your tank-top domes and safely compress it for storage tanks or direct combustion uses.

Because of the dangerous nature of sludge gases, the *absence* of static or surface friction in the impeller action of POTTSTOWN EXHAUSTERS provide the safest method of handling. And with substantial economies possible in the use of sludge gas (600 to 700 lb. b.t.u.) as a source of heat or power —your operating *costs are DOWN—with POTTSTOWN!*

***WRITE TODAY for our new Bulletin No. P-100***

**ALLEN BILLMYRE COMPANY**
**440 Fayette Ave. Mamaroneck, N. Y.**

**POTTSTOWN**
ROTARY POSITIVE DISPLACEMENT
BLOWERS AND EXHAUSTERS

*How Much Does A Patch Cost?*

# Flexible Machine Saved
## 52 CUTS IN THE STREET

Patches in the street are "SIGNS" of wasted time, money and labor because they're seldom necessary when modern Flexible pipe cleaning methods are used.

In the picture above, the Flexible equipment and crew, located in an out-of-the-way place, are cleaning a city pipe line without cutting into the street.

Every pipe cleaning job is different. That is why you should take advantage of Flexible experience and Flexible specialized equipment. A fleet of Flexible service trucks with complete crews and equipment are at your city's service.

Call or write your nearest Flexible representative. He will be glad to estimate the cost of cleaning all or part of your pipe line system.

*Figure the cost of digging, the cost of back filling, the cost of detouring traffic, the cost of patching, the cost of repaving the street – these are the costs of an unnecessary patch in the street.*

**FLEXIBLE WILL CLEAN ANY PIPE FROM 2 TO 72 IN.**

**FLEXIBLE UNDERGROUND PIPE-CLEANING CO.**

615 Pickwick Bldg. Kansas City 6, Mo.
1624 Harmon Place Minneapolis 3, Minn.
P. O. Box 694 Gulfport, Miss.
41 Greenway St. Hamden, Conn.

9059 Venice Boulevard
Los Angeles 34, California

401 Broadway New York 13
2645 E. 75th St. Chicago 49
P.O. Box 694, Pittsburgh
P.O. Box 165, Atlanta
147 Hillside Ter., Irvington, N. J.

High sustained efficiency and low maintenance costs are inherent characteristics of Cook Deep Well Turbine Pumps—the *only* Turbines having *all these features!* 1—Easy adjustment of Impellers. 2—Pin Clutch Safeguard against damage to motor and line shaft. 3—Oil or water lubrication. 4—Precision tested Impellers of Red Brass mathematically designed to give *maximum upward thrust* to water column. 5—Stream-lined passage through bowl minimizes friction and turbulence, *delivers greater gallonage at head.* Many other salient reasons for the swing to Cook Turbine Pumps are shown in Catalog 360-A, free on request . . . Ask for your copy, today.

COOK

**DEEP WELL TURBINE PUMPS**

*Oil or Water Lubricated*

**A. D. COOK, INC.** • Lawrenceburg, Indiana


of this columnist's brow—my landlord decided to come back and live in his own house. With no houses or apartments to rent, there was nothing to do but to buy a place. Well, buying a house takes a lot of time and tramping; it was only after looking at 53 places, that we ("Gin" and I) finally decided on one on a hill-top in the next block.

First thing we noticed was the fire hydrant in the front yard. I checked it, and it's O. K.; it was made by one of the advertisers in W.W.&S.—Next job was to get the water turned on in the house and the meter installed. I should have preferred to have a new or reconditioned meter, but our water company only changes them every seven years so we have the same one the previous owner had. I checked the name on the meter—another advertiser; curb box, ditto.—Now that I am a property owner I think I'll look in on our water and sewage plants. Perhaps I should look in on the Commissioner of Public Works in our county; a fellow named Jim Harding.

* * * *

In the request last month for contributions to this column I overlooked the fact that as long as


INSTALLATIONS WORLD WIDE

LARGEST CITY TO SMALLEST VILLAGE

VALVES COMPLETE EQUIPMENT FOR WATER WORKS FILTRATION AND SEWAGE DISPOSAL PLANTS LATEST "COREY TYPE" HYDRANTS

Write for Catalogue and Information

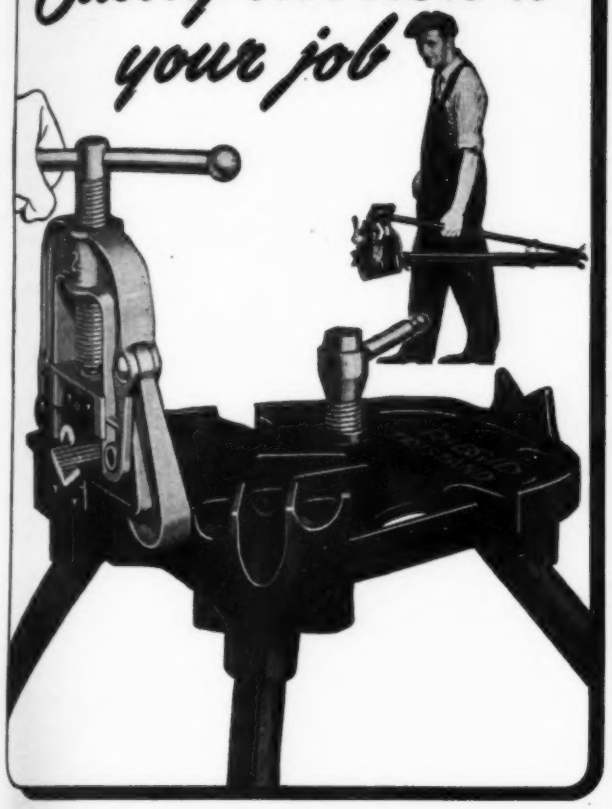
IOWA VALVE CO.

General Offices:
Hubbell Bldg., Des Moines, Iowa

Plants:
Oskaloosa, Iowa

# An Efficient work-bench

*Easily carried to your job*



RIGID

## Portable Tristand Vise

•This roomy Tristand folds up snugly, carries easily, sets up solid anywhere you need it. Screw-down feet and ceiling brace if you want them. Lots of space for oil can and dope pot, plenty of slots to hang tools. It has a pipe rest and 3 handy pipe benders – and an efficient vise with LonGrip jaws, easy on polished pipe. Buy it for easier work— at your Supply House.

*Tristand Chain Vise.*

RIGID

**WORK-SAVER PIPE TOOLS**

THE RIDGE TOOL COMPANY • ELYRIA, OHIO, U. S. A.

# *Hooker Chemicals and Chemists are ready to help you*

Water sterilization is one place where no halfway measures can be tolerated. Continuous perfection is a "must" where the health of a community is involved. That's why so many water works officials look to Hooker Electrochemical Company as their source for Chlorine.

Pioneers in the preparation of electrolytic chlorine, Hooker, for many years, has been supplying water works, filtration plants and sewerage systems with the uniformly and dependably high quality liquid chlorine that has enabled the United States to cut down disease from water borne bacteria.

Chlorine in some form is accompanying our men in the armed forces and making their water supply safe wherever they may be. Hooker chlorine is mighty active outside the waterworks field, because this busy chemical is a partner in the manufacture of many varied products.

Hooker offers you the highest quality liquid chlorine and technical assistance in problems which you may have in the handling of chlorine. "Hooker Liquid Chlorine" is a booklet containing helpful information on the handling of chlorine, equipment and containers. Your new employees particularly, will find it useful. Copies are free when requested on your letterhead.

ARMY E NAVY

**CHLORINE**

**CAUSTIC SODA**

**BLEACHING POWDER**

**FERRIC CHLORIDE**

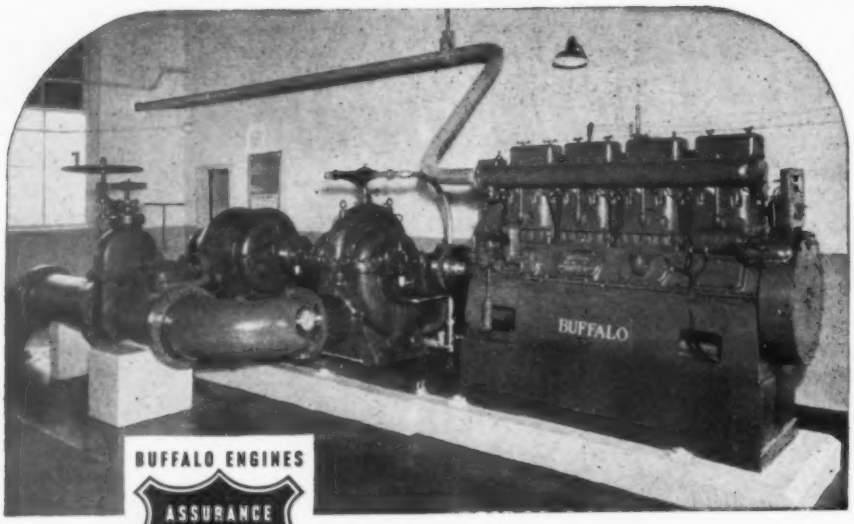
5174

**HOOKER CHEMICALS**

**HOOKER ELECTROCHEMICAL COMPANY**

Buffalo Ave. & Ward St., Niagara Falls, N. Y.

New York, N. Y. • Tacoma, Wash. • Wilmington, Calif.




*9 MGD DeLaval Pumps installed at the Godwin St. Station, City of Portsmouth, Va. A Buffalo RAB-8 Gasoline Engine is ready as stand-by equipment.*

# BUFFALO ENGINES

## *Reduce Insurance Costs!*

THE value in dollars and cents of a BUFFALO ENGINE for emergency power is not set by its F.O.B. price or its cost of installation. It is set by the Fire Underwriters as the sum of the savings from lower premiums for insuring a community or industry that has this protection. Therefore, ownership of a BUFFALO ENGINE is always profitable.

BUFFALO ENGINES always give assurance of protection and in addition they offer the extra benefits of full rated power, clean, quiet and vibration-free operation and quick starting by manual, remote or full automatic control.

Engineers and others interested are invited to write for specification sheets and data on any type of installation.

**BUFFALO GASOLENE MOTOR COMPANY**

**DEPT. WW-45 BUFFALO 13, N. Y., U. S. A.**

BUFFALO ENGINES
ASSURANCE of PROTECTION

BUFFALO ENGINES — 100 H. P. THROUGH 750 H. P.— IN GENERATOR AND PUMPING SETS FOR WATER WORKS — AIRPORTS — COMMUNICATIONS — FLOOD CONTROL — HOSPITALS — INSTITUTIONS — MINES — MOVABLE BRIDGES — THEATRES — SEWAGE PLANTS.


"Barney" Barnes of Bowling Green, Ohio, continues to send me copies of *"Buckeye Sludge,"* I won't have any trouble keeping up with the doings of the boys in the Ohio Sewage Works Conference. The last issue (which I think was edited by Jim Turner of Mansfield—or was it?) has so much in it that it is hard not to turn this column over to reprinting the whole thing. But here are a few gleanings from the Feb. issue: Dick Snyder, past Chair. of the Ohio Conf. and Supt. of Massillon, not only paid his dues on time but sent in an extra $5 to pay the dues of one Capt. Al Hall (formerly of the Ohio Health Dept.). And here's Dick's reason, "To send Al Hall a Christmas present in return for his filling his place at the front for us who have it easy on the home front."—C. E. Britt writes that the reason he likes sewage plant operators is that they are not too cocky, "for who could be cocky while cleaning out a sludge pump."—More next month.

* * * *

Jim (Main Cleaning) Brown, of Chicago, and the W.P.A. of the Ill. Sect. AWWA has turned semi-poetic. At least he has deemed the following bit, as verse:

"Lives there a man with soul so dead
Who hasn't looked over his shoulder
and said,
'Not bad—NOT BAD!!'"

* * * *

It is rumored that this column is becoming a favorite with the distaff side of "Bert" Berry's staff in Toronto. Adding these delightful ladies to the list of my feminine readers makes me wonder if perhaps I shouldn't include a "ladies' aid section" in each issue.—Oh yes! I do have other feminine readers. As a matter of fact before the column


..for ACCURACY and TROUBLE-FREE OPERATION

INSIST ON THE **WILSON** HYPO-CHLORINATOR

*Engineered and Manufactured by*

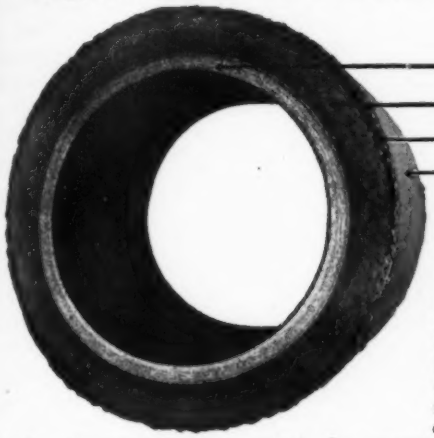
**WILSON**

**CHEMICAL FEEDERS, INC.**

203 CLINTON STREET BUFFALO 4, N. Y.

*Often Clean Sand Will Protect Pipe from Corrosive Attack in Active Soils;*

IN EXTREME CASES USE ARMORED MONO-CAST PIPE

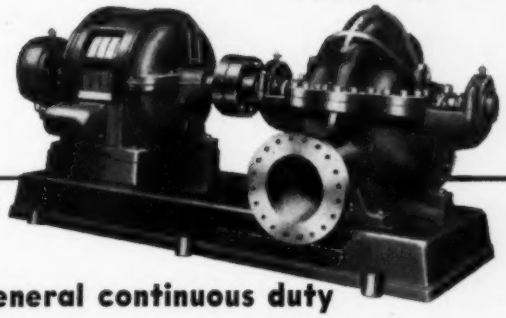



Ordinarily a bed of clean sand 3 to 6 inches deep on which the pipe is laid and a clean sand covering of equal depth will protect pipe against the corrosive attack of active soils. Some areas, however, such as swamps, muck, brackish or salt marshes and severe alkali soils are so vicious in their corrosive attack that even corrosion-resisting Mono-Cast Centrifugal Pipe should be armored to assure permanence. Armored Mono-Cast Pipe will give lasting service in such severe and corrosive areas where the sand or other treatment may not be effective. Further information gladly supplied on request.

American Cast Iron Pipe Company
Birmingham 2, Alabama
Sales Offices in Principal Cities

*TYPE "A" DAYTON-DOWD CENTRIFUGAL PUMP*

- WATERWORKS
- INDUSTRIAL PLANTS
- FILTRATION PLANTS
- MINES, ETC.



For general continuous duty

**PUMPING SERVICE**

**TYPES** — Single stage, single suction, sizes 2" and 3" Single stage, double suction, sizes 2½" to 42" Capacities up to 60,000 G.P.M.

**SPLIT CASE DESIGN** — For easy accessibility. Available in either cast iron, chrome iron, cast steel, bronze, monel and other alloys.

**IMPELLER** — High efficiency design. Made of cast bronze. Also available in KA-2 stainless steel, cast carbon steel, monel or other alloys.

**DRIVE UNITS** — Pumps can be supplied with dual drive hookup; electric motor and steam turbine; electric motor and gas engine. Twin pumps also available with one electric motor

**FREE CATALOG** — Write on your business letterhead for interesting FREE Catalog. Address: DAYTON-DOWD COMPANY, Dept. S-14, Quincy, Illinois.

**DAYTON-DOWD**
Turbine Pumps • Centrifugal Pumps

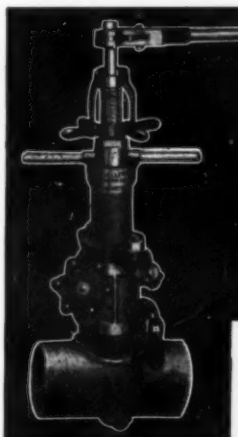
**Over 225 P.F.T. Floating Covers in War Service**

The health of our fighting men and war workers is being safeguarded by modern sewage disposal plants. We are doing our part by delivering on time P.F.T. Floating Covers and other sewage treatment equipment.

The P.F.T. Floating Cover for single and stage digestion hastens the digestion process, and provides for utilizing the sewage gas to heat water for the digester tank.

Catalog No. 232 contains complete information, including specifications. Write for your copy.

P.F.T. PACIFIC FLUSH-TANK CO.
4241 Ravenswood Ave., Chicago, Ill.
New York Charlotte, N. C.



**THE LEADER FOR YEARS**

"B" Tapping Machine

Mueller invented the first machine for tapping and inserting corporation stops under pressure in 1871. Today the MUELLER machine is still the accepted standard everywhere—in use by 95% of all water works . . . Why? Because it is easy to use, operates in any position, adapts itself to many kinds and sizes of pipe, needs no water shut-off, and saves YOUR time and YOUR money throughout its long life . . . A MUELLER machine with MUELLER corporation stops—the perfect combination.

**MUELLER CO.**
**DECATUR, ILL.**

WRITE FOR INFORMATION

VOGT BROTHERS TRAFFIC MODEL FIRE HYDRANT

A.W.W.A.

VOGT BROTHERS MFG. CO. Incorporated LOUISVILLE, KY.
MAIN AT 14th
VOGT
VOGT MFG. CO., Incorporated
P. O. BOX 1122 LOUISVILLE, KY.

AERO-MIX AERATOR—MIXER

A Size and Type to Fit Your Problem in Water or Sewage Treatment.

WRITE FOR INFORMATION

# PLANNING A SMALL PLANT?

If you are . . . or will be planning a small sewage-treatment plant . . . you will want to know, *in advance* . . . how your community can be *fully* protected by *complete* sewage treatment, comparable to the *best* in larger cities.

Get the facts by calling in a Rex Sanitation Engineer. There is no obligation. Plan with him. Let him show you the simplicity, economy and efficiency that Rex Sanitation Equipment makes possible in small sewage-treatment plants.

**Here are a few of the many advantages offered by Rex:**

The Rex "M.I." type mechanically cleaned Bar Screen is engineered specifically to give all the advantages in design and construction found in large plant units.

The Rex "M.I." Conveyor Sludge Collector and Skimmer reduces installation costs and maintains plant efficiency.

The Rex "M.I." Grit Collector is a simple, ruggedly constructed unit that assures low installation cost and high efficiency for the smaller plant.

Blueprint Now!

The Rex Aero-Filter is an exclusive process that eliminates the need for excessive recirculation and oversize primary settling tanks. It materially reduces the size and operating cost of the plant.

Specially trained Rex sanitation engineers can help you with your problems. For complete information, write Chain Belt Company, 1610 West Bruce Street, Milwaukee 4, Wisconsin.

*Rex "M.I." mechanically cleaned Bar Screen and Rex Grit Collector.*

*Rex Aero-Filter permits much larger daily capacities with smaller filter bed.*

*Small primary settling tanks equipped with Rex "M.I." Conveyor Sludge Collectors.*

REX **SANITATION EQUIPMENT**

*Triturators • Bar Screens • Tow-Bro Sludge Removers • Slo-Mixers*
*Aero-Filters • Rapid Mixers • Grit and Sludge Collectors and Grit Washers*

**CHAIN BELT COMPANY OF MILWAUKEE**

*Member of the Water and Sewage Works Manufacturers Association, Inc.*


is ever set in type three of its first four readers are of the feminine gender. Mrs. S. comes first, then the editor's secretary, Miss Ryan, and then Miss Sanders, make-up editor of W.W.&S.

And after it is printed I know Irene Rumsey (wife of the Old Maestro of Michigan) says each month, "Let's see what Doc has to say." And then there is Bill Clark's wife in Toledo. And now to the list can be added Helen Ball, Mrs. DeLaporte, Mrs. Galimbert and who else?—How about it girls do you want a special paragraph each month, just for you?

* * *

Apparently I owe some one or several persons an apology for having had the effrontery to inquire as to what the $P_3B_3P_2$ Association is. Shortly after the March issue hit the newsstands, I received the following letter: "Dear Doc: Being a charter member of the $P_3B_3P_2$ Assoc. along with I.M.G., H.K., M.S., and 'S.' S., et al. (could that mean ethyl alcohol?) I am surprised to read in your column that you ask for an explanation of the significance of the symbols. . .

"This is a secret organization of the same ancient vintage as most whiskeys obtainable nowadays. . . . I protest your method of publicly advertising for information on the Assoc.

"Because of my desire to promptly express my disapproval of your unethical action . . . etc. Should you have an honest desire to learn the significance of $P_3B_3P_2$ I suggest you make formal application to the Pres. of the Membership Committee . . . and if you are elected, then and then only will you learn the revered symbols $P_3B_3P_2$. Signed, W. A. Darby, Supreme Keeper of the B's."

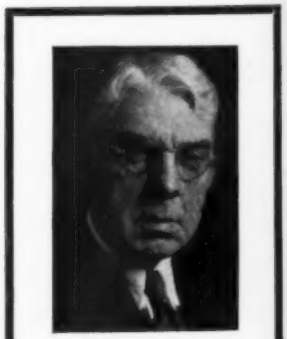
So it's a secret society? Well, I'm glad to know who the Keeper of the B's is, but before I apply, I want to know, "who is the Supreme Keeper of the P's?"

# MANUFACTURERS' and EQUIPMENT News

## George Horton Succumbs After Auto Accident

**Enjoyed Reputation as Outstanding Tank and Gas Holder Designer**

George Terry Horton, president of the Chicago Bridge and Iron Co. for past 33 years, died suddenly on March 19th following an automobile accident in Chicago. He was 71 years old.



**George T. Horton**

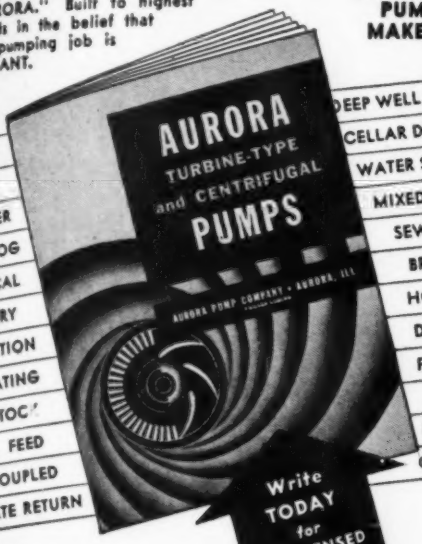
Mr. Horton had been associated with the company founded by his father, Horace E. Horton, ever since he was graduated from R.P.I. in 1893. He was elected president of the company after his father's death in 1912.

## PUMPS YOU CAN TRUST

If you are a user of pumps FOR ANY PURPOSE you will welcome acquaintance with the modern, efficient and lasting "PUMPS by AURORA." Built to highest standards in the belief that EVERY pumping job is IMPORTANT.

BUILT by EXCLUSIVE PUMP MAKERS

SUMP
BILGE
TRANSFER
NON-CLOG
CHEMICAL
REFINERY
DISTILLATION
CIRCULATING
PAPER STOCK
BOILER FEED
CLOSE-COUPLED
CONDENSATE RETURN




DEEP WELL TURBINES
CELLAR DRAINERS
WATER SYSTEMS
MIXED FLOW
SEWAGE
BRINE
HOUSE
DAIRY
FARM
AND
MANY
OTHERS

Write TODAY for CONDENSED CATALOG

— or See Our Catalog in SWEETS

DISTRIBUTORS IN PRINCIPAL CITIES

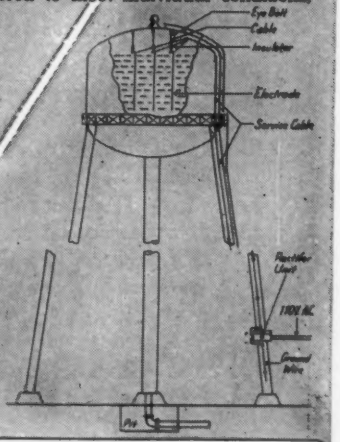
AURORA Always PUMPS

AURORA PUMP COMPANY

68 Loucks St., AURORA, ILLINOIS

## STOPS TANK RUSTING *Below the Water Line* PERMANENTLY!

Rust below the water line is by far the most troublesome, expensive and destructive item of tank maintenance. But it can be eliminated completely—permanently. A proven electrolytic system (Cathodic Protection), carefully engineered to meet individual conditions, stops all rust formation—even removes old rust. Installed without draining the tank. Costs pennies to operate. Safe, low voltage. No paint, no chemicals. And no more rust, no more scraping or painting. Applicable to many types of submerged metal equipment. Method approved by Associated Factory Mutual Laboratories, War Department (Chief Engineer's Office) and American Water Works Assn. Write for facts—NOW.




ELECTRO RUST-PROOFING *Corporation*

DAYTON 10, OHIO, U.S.A.

## ZECO GREENSAND ZEOLITE

ZECO and HI-ZECO Greensand Zeolite for water softening, filtration and iron removal. ZECO Manganese Zeolite for iron and manganese removal. COREXITE mineral for corrosion control and water stabilization.

ZEOLITE CHEMICAL CO.

Sales Office: 140 Cedar St., New York, N. Y. Factory: Medford, N. J.

Pioneer Producer of GREENSAND ZEOLITE MINERAL

## EDSON DIAPHRAGM PUMPS

Hand Sizes 2", 2½", 3", 4"
Power Sizes 3" and 4"
Open Discharge or Force Pump
Edson Special Suction Hose
Red Seal Diaphragms
Strainers and Foot Valves
Hose Spanners—Adapters

THE EDSON CORPORATION
Main Office and Works: 49 D St. South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn

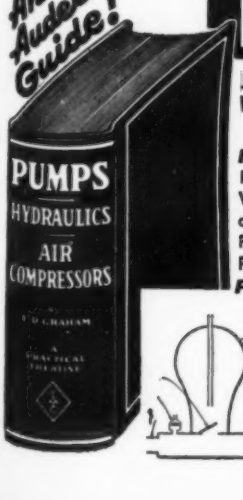
## BAILEY METERS AND CONTROLLERS

FOR SEWAGE TREATMENT AND WATER SUPPLY . . .

● Venturi Tubes, Weirs, Flumes, Nozzles and other primary elements; Mechanically and Electrically operated Registers and Complete Automatic Control Systems.

BAILEY METER COMPANY
1072 IVANHOE ROAD • CLEVELAND O.
Bailey Meter Co. Ltd., Montreal, Canada

An Audel Guide!

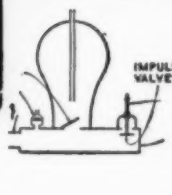



## PUMPS-HYDRAULICS-AIR COMPRESSORS

JUST OUT! 3 BOOKS IN ONE—OVER 1650 PAGES, 1654 ILLUSTRATIONS, WITH QUESTIONS AND ANSWERS. COMPLETE PRACTICAL CONCISE INFORMATION FOR ALL ENGINEERS AND OPERATORS.

**PART 1—PUMPS—850 Pages:** All types—Centrifugal—Rotary—Reciprocating Pumps: Their Theory, Construction, Operation and Calculations. Air and Vacuum Chambers—Power Pumps—Air Pumps—Jet Condensers—Surface Condensers—Condenser Auxiliaries—Condenser Operation—Calculations—Cooling Ponds—Cooling Towers—Water Supply—Hydraulic Rams—Special Service Pumps—Automotive Fire Pumps—Dredges—Codes. 942 Illustrations.

**PART 2—HYDRAULICS—320 Pages:** Hydraulic Physics—Drives—Machine Control—Accumulators—Elevators—Hydraulic Airplane Control—Automobile Brakes—Shock Absorbers—Presses—Turbines. Many new uses explained. 310 Illustrations.




**PART 3—AIR COMPRESSORS—406 Pages:** Compression of Air—Compressor Classification—Parts, Types—Inter and After Coolers—Regulating Devices—Installation—Lubrication—Operation—Maintenance—Blowers—Super-Chargers—Pneumatic Hand Tools—Ready Reference Index and Tables. 402 Illustrations.

## Free Examination

TO GET THIS ASSISTANCE FOR YOURSELF SIMPLY FILL IN AND MAIL YOUR ORDER TODAY

$4 PAY ONLY COMPLETE $1 A MO.

AUDEL, Publishers, 49 West 23 St., New York 10, N.Y.
Send postpaid AUDELS PUMPS, HYDRAULICS, AIR COMPRESSORS ($4). If I decide to keep it, I will send you $1 within 7 days; then remit $1 monthly until purchase price of $4 is paid. Otherwise, I will return it promptly.

Name.....
Address.....
Occupation.....
Employed by..... P-24

OUT LIKE A LIGHT!
A Mathews hydrant that needs fixing comes out of the ground like a light-bulb from its socket. Just give the hydrant a few turns. It unscrews and is ready for a trip to the shop. In its place goes a spare that screws into position just as easily. You never have to dig to fix a properly set Mathews hydrant, never have to make emergency, on-the-spot repairs. When work-crews have time on their hands, they can service the hydrant in the shop. The Mathews barrel contains all working-parts, including main and drain valve-seats. It unscrews from the elbow and lifts out through the loose protection-case. For vital fire protection, and important maintenance economies, specify Mathews protection for your community!
MATHEWS HYDRANTS
Made by R. D. WOOD Company
400 CHESTNUT STREET, PHILADELPHIA 5, PA.
MANUFACTURERS OF SAND SPUN PIPE (CENTRIFUGALLY CAST IN SAND MOLDS) AND R. D. WOOD GATE VALVES


Mr. Horton, trained as an engineer, was responsible for many of the company's unique designs of elevated tanks and gas holders developed during his long association with the company. Only recently he had received a service pin commemorating his fifty-two years with the company.

Mr. Horton was a life trustee for his alma mater, Rensselaer Polytechnic Institute. He was chairman of the Chicago Plan Commission in 1940-1943, and president of the American Welding Society in 1939-40. He was also an honorary member of the Western Society of Engineers, as well as a member of the American Society of Civil Engineers, the Am. Water Wks. Assoc., the Soc. for Testing Materials, the Society of Naval Architects and Marine Engineers, the Am. Petroleum Inst., the Chicago Engineer's Club, and the Engineers' Club of New York.

## W.S.W. Manuf's Assoc. Moves

**170 Broadway, Cor. Maiden Lane, Is New Address**

The headquarters of the Water and Sewage Works Manufacturers Association were moved on March 29 to Room 308, 170 Broadway, New York 7, N. Y.

Arthur Clark, Secretary-Manager of the Association calls attention to the fact that this new location, Broadway, corner of Maiden Lane, was the first "formal" office of the American Water Works Association under Secretary Diven, from 1924 until 1928.

A notice concerning this change of address has been sent to all member-manufacturers, and publications, and all persons interested should correct their mailing lists accordingly.


MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

KNOWN AROUND THE WORLD AS THE SIGN OF EXCELLENCE IN WATER TREATMENT EQUIPMENT

The years of experience behind the Roberts nameplate is your assurance that any water rectification problem is expertly handled to your best advantage. As manufacturing and installation engineers, the Roberts organization is equipped to meet your exact needs regardless of the size of the equipment or the complexity of the problem.

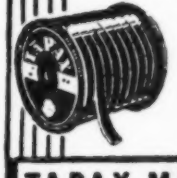
GRAVITY FILTERS • SOFTENING PLANTS AND EQUIPMENT • PRESSURE FILTERS ZEOLITE SOFTENERS • SWIMMING POOL RECIRCULATING APPARATUS SPECIAL WATER TREATMENT EQUIPMENT

*We invite your inquiries*

ROBERTS FILTER MANUFACTURING COMPANY • *Darby, Pa.*

TAPAX

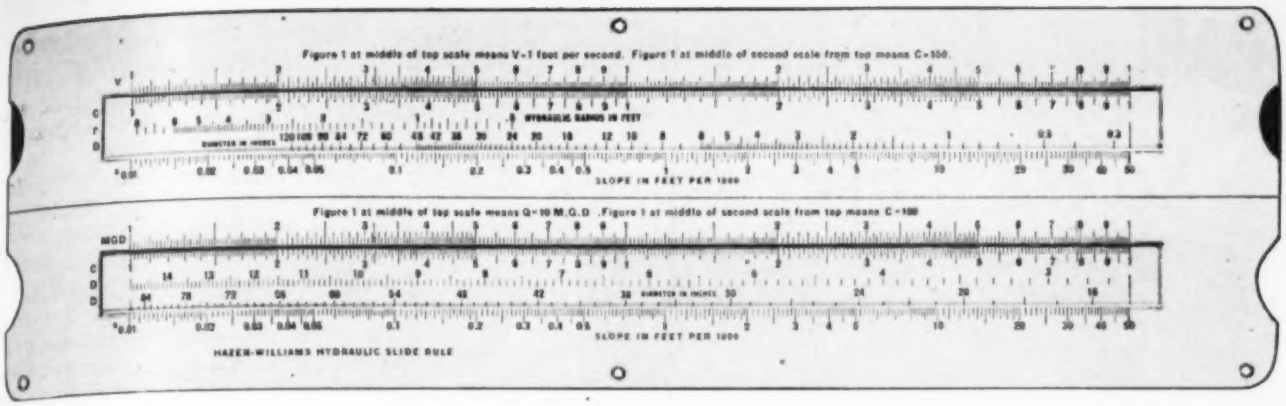
*The* ORIGINAL *and* FINEST....



Manhole Cushion U. S. Pat. No. 2,050,050 offers you the simplest solution for noisy, rattling covers. Easy to install. Lasting — Economical.

Write for story of Tapax and Trial Offer.

TAPAX MFG. CO., INC.
MAMARONECK NEW YORK




## Hydraulic Slide Rule Offered by Lock-Joint Pipe

While the Hazen-Williams Hydraulic Slide Rule has been known for a long time to sanitary engineers, it has not been procurable for some time in its original form, that form having been manufactured in Germany before the war.

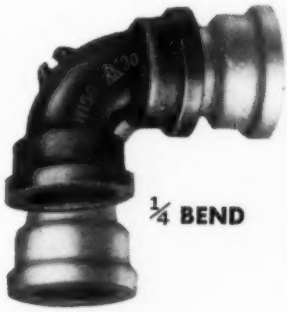
The Lock Joint Pipe Co. of East Orange, N. J., however, has produced a very acceptable variation of the original rule. This particular rule, which may be obtained from the Lock Joint Pipe Co. by writing to Box 269, East Orange, N. J., is pictured herewith. It will be sent with the compliments of the company. The rule is made of durable glossed cardboard with plastic protected slide. A set of directions for this particular model are supplied with the rule.

With this rule one may quickly determine velocities, quantities, or the value of the friction coefficient "C." Problems and examples are given and worked out in the instruction folder. On the back side of the rule will be found useful conversion factors and coefficients which have been found correct for computations.

We consider it a highly worthy gift at the mere cost of a postage stamp and the effort of asking for it.

## Dr. C. F. Burgess Passes

Dr. C. F. Burgess, the founder and a director of the Burgess-Manning Co. of Chicago, Ill., passed away on February 13, 1945. Dr. Burgess is well known for his work and the company which he founded will serve as a monument to his foresight, judgment, and scientific ability. Dr. Burgess was the originator of the snubbing principle for quieting Diesel exhausts.


*Comparative Weights*

| | GRINNELL | COMPETITION |
|---|---|---|
| 4″ | 70 lbs. | 94 lbs. |
| 6″ | 106 lbs. | 140 lbs. |
| 8″ | 148 lbs. | 211 lbs. |
| 10″ | 216 lbs. | 280 lbs. |
| 12″ | 305 lbs. | 366 lbs. |

**FOR EASE OF HANDLING**

**it pays to use**

**Grinnell Socket Fittings**

***Improved design reduces size and weight***

Grinnell socket fittings are easier to handle, fit into close quarters and speed installation because their improved design reduces size and weight. Friction loss is actually reduced. Socket and spigot dimensions and wall thickness are the same as AWWA standard Class D pipe. Approved by Underwriters' Laboratories.

Provided with lugs to take socket clamps. Special coating of coal-tar pitch varnish. Write for catalog, "Water Works Specialties".

GRINNELL COMPANY

EXECUTIVE OFFICES, PROVIDENCE 1, R. I.

**Branch Warehouses**

Atlanta 2, Ga.
Charlotte 1, N. C.
Chicago 9, Ill.
Cleveland 14, O.
Houston 1, Tex.
Los Angeles 13, Cal.
Minneapolis 15, Minn.
New York 17, N. Y.
Oakland 7, Cal.
Philadelphia 34, Pa.
Providence 1, R. I.
St. Louis 10, Mo.
St. Paul, Minn.
San Francisco 7, Cal.
Seattle 1, Wash.

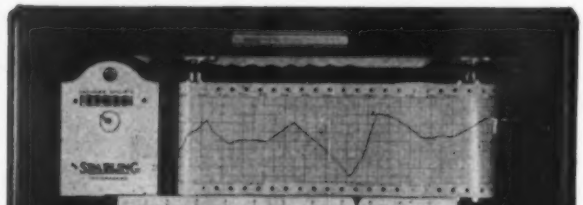
**GRINNELL**

**WHENEVER PIPING IS INVOLVED**

# SPARLING MAIN-LINE METERS

*and the*

# 60-DAY RECORDERS



## Give You the FACTS

ACCURATE knowledge of mainline flows is indispensable. Sparling Meters, assuring consistent accuracy of measurement, are easily installed at comparatively little cost to give you complete information.

*Bulletin 308 comes at your request*

SPARLING

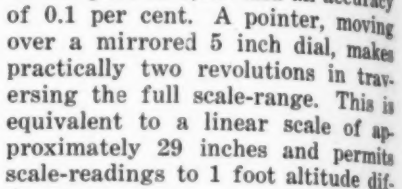
*Manufacturer of Water Measuring Equipment*

LOS ANGELES 54, Box 3277, Terminal Annex — 622 Broadway.....CINCINNATI 2
CHICAGO 16.....3104 South Michigan Ave. — 101 Park Avenue.....NEW YORK 17
BOSTON 8.....6 Beacon Street


## High Precision Altimeter Offered by W&T

High sensitivity and precision are combined in the rather remarkable altimeter recently developed by Wallace & Tiernan Products, Inc., Belleville, N. J. It is ideally suited for use in surveying, prospecting for water supply sources, and other engineering uses.

The instrument has a sensitivity of one part in 8,000 and an accuracy of 0.1 per cent. A pointer, moving over a mirrored 5 inch dial, makes practically two revolutions in traversing the full scale-range. This is equivalent to a linear scale of approximately 29 inches and permits scale-readings to 1 foot altitude differences.




The altimeter is normally furnished in either a 7,000 or 15,000 foot range with 10 and 20 foot graduations, respectively. Other scales and scale-ranges can be supplied to meet special conditions.

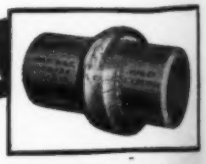
Inherent temperature compensation of the instrument is extremely high, so that no special compensating elements are necessary. The altimeter deviation is less than 0.1


# *Leopold*

GLAZED FIRE CLAY TILE FILTER BOTTOM
*Non-Corrosive—Permanent*
DRY CHEMICAL FEEDERS
*Accurate—Dependable*
*also*
COMPLETE WATER TREATMENT EQUIPMENT

**F. B. LEOPOLD CO., INC.**
422 FIRST AVE. PITTSBURGH 19, PA.

WESTON



**GASKET AND FORM**

**The Perfected Method for Making Sewer Pipe Joints of Cement**

- No jute used—gasket centers spigot.
- Definite space in each joint for cement.
- Form confines cement-grout to lower portion of joint.
- Particularly advantageous in water-bearing trenches.
- Infiltration minimized.

**L. A. WESTON** Adams, Mass.

foot per degree F. temperature change. The instrument is thus particularly suitable for work involving instantaneous readings over wide ranges of temperature and pressure. Because of absence of friction, tapping of the dial is unnecessary when taking a series of readings. Drift of the pointer with time is also negligible.

Unique simplicity of design helps the instruments to hold their accuracy under severe usage conditions. For portable service, these 2 lb. 8 oz. instruments are available in shockproof protective cases measuring 6x6x4 inches.

For additional information request Technical Publications 250 and 251 giving specifications and describing this precision altimeter, many of which have been produced by W & T for the U. S. Corps of Engineers and other fighting forces. Address Wallace & Tiernan Products, Inc., Belleville, N. J.

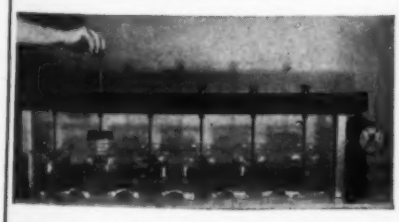
## Spelled Northrop— Pronounced Northrupp

**But Our Typewriter Should Spell and Not Pronounce (Correction Please!)**

In our March issue, Ad. page 84, appeared an announcement which said, "Northrupp and Co., Inc., N. Y. City, makers of Bondo jointing compound, has made arrangements to distribute the Chase Brass and Copper line of copper tubing, fittings and water works brass goods."

Now anyone connected with the water works field knows that Bondo is made by Northrop and Co., Inc., New York, N. Y. If Guy Northrop is as touchy about the spelling of his name as we are about ours, we hope this apology will suffice. We hope, too, that the misspelled name in the announcement has not caused any orders to go astray.


THE *Phipps & Bird* LABORATORY MIXER . . .



IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.

PHIPPS & BIRD, INC. Richmond, Va.



SMITH TAPPING SLEEVES

THE A.P. SMITH MFG. CO. EAST ORANGE, N.J.

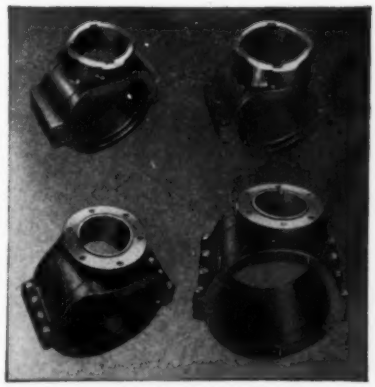
*Symbol of Quality Since 1889*

MAKING PRESSURE CONNECTIONS *Without Stopping the Service*

SMITH Tapping Sleeves for making pressure connections to A.W.W.A. standard mains, classes A, B and C, and for pressures up to 150 lbs. per square inch, are made in four types, here illustrated. At top: 1. Clamped Sleeve Joint; 2. Bolted Sleeve Joint. Bottom row: 3. Bolted Sleeve Joint with flanged end joint valve connection; 4. Hackensack Sleeve Joint with flanged end joint valve connection.

OTHER SMITH PRODUCTS — Valves and Hydrants — Valve Inserting Machines — Tapping Sleeves — Tapping Valves — Hat Flanges

*Write for Catalog*



A. P. SMITH TAPPING SLEEVES

*Branches*

7 So. Dearborn St., Chicago 3, Ill.
409 Texas St., El Paso, Texas
315 N. Crescent St., Flandreau, S. D.
1221 Mortgage Guarantee Bldg., Atlanta, Ga.
428 13th St., Oakland 12, Calif.
524 First Ave. S., Seattle, Wash.
1317 Oakley St., Orlando, Fla.
54 Elm Street, Melrose 76, Mass.

THE A. P. SMITH MFG. CO., EAST ORANGE, N. J.



AMERICAN GAS BOILERS

STEAM AND WATER TYPES

FOR DIGESTER HEATING

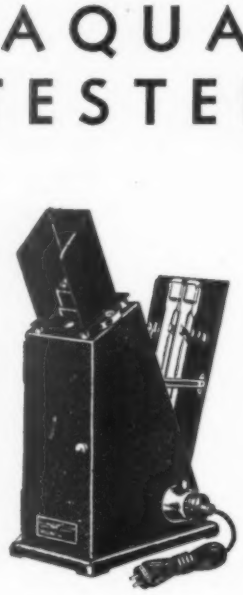
*SEE DATA PAGE IN ANNUAL REFERENCE SECTION*

AMERICAN RADIATOR & Standard Sanitary

*New York* CORPORATION *Pittsburgh*

SALES OFFICES IN ALL PRINCIPAL CITIES

# HELLIGE AQUA TESTER



For the accurate analysis of water, sewage, and industrial wastes, permanent glass color standards for all popular methods published by A.P.H.A. and A.W.W.A. are available. This model is, we believe, the most advanced type ever brought on the market. The ease of operation and permanent reliability make the apparatus a most desirable piece of equipment for any water laboratory.

Write for Bulletin 602

**HELLIGE**
INCORPORATED
3718 NORTHERN BOULEVARD
LONG ISLAND CITY 1, N. Y.


## McArthur Boosted by Dorr

**Becomes Genl. Sales Mgr.**

C. K. McArthur has been promoted by The Dorr Co. to Manager of Sales covering United States, Mexico, Canada, Newfoundland and Alaska. For the past two years Mr. McArthur has been manager of Dorr's Metallurgical Division. His headquarters continue to be in New York.

Mr. McArthur joined The Dorr Co. as a sales engineer in 1926 and has since broadened a metallurgical background through engineering operations for Dorr in the United States, Canada, South America and Mexico.

## Nat'l Water Main Cleaning Co. to Be Represented by Rohan of Texas

According to a recent announcement, arrangements have been made for the Rohan Co., Inc. of P.O. Box 887, Waco, Tex. to represent the National Water Main Cleaning Co. of New York. Mr. George J. Rohan, former superintendent of the Waco Water Works is president and general manager of the Rohan Co., which will also represent several other water works lines.


# HYDRO-TITE

**HYDRO-TITE** — The self-caulking joint compound that makes cast iron water pipe joints — strong — tight — flexible and everlasting. Used on thousands of miles of pipe with a record of more than 30 years without a failure.

**FIBREX** — The sanitary paper packing that is used like braided jute. Free from bacteria — treated with a water repellent — put up in 60 pound reels. 70 pounds of Fibrex takes the place of 100 pounds of braided jute.

**HYDRAULIC DEVELOPMENT CORPORATION**
50 Church St.
New York, N. Y.

DRY BRAIDED
Fibrex



*Already a* **PROVED PRODUCT**

# THE PIPE OF TOMORROW

- House-to-Sewer Connections
- Downspouts
- Industrial Waste Drainage
- Septic Tank Filter Beds (Perforated)
- Foundation Drains (Perforated)

The same materials — cellulose fibre and coal tar pitch—of which ORANGEBURG PIPE are made have a successful service record of 50 years in ORANGEBURG underground electrical conduit. TAPERWELD joints assure a permanent watertight, root-proof line. Non-corrodible.

Write for bulletins showing mechanical strength, hydraulic and chemical properties. THE FIBRE CONDUIT COMPANY, DEPT. WW, ORANGEBURG, N. Y.

**ORANGEBURG**

## B.I.F. Celebrates 125th Anniversary

**Believes the First 100 Yrs. Really the Hardest**

Builders Iron Foundry and its affiliates, Builders-Providence, Inc., %Proportioneers, Inc.% and Omega Machine Co., Providence, R. I., recently held a triple celebration to commemorate the company's 125th anniversary to honor 70 employees having from five to fifty-four years of service and to celebrate the award of the Fifth Army-Navy E just received by the concern.

H. S. Chaffee, Pres. (right), congratulates H. S. Dolbey (left) on 54 Years of Service

Two hundred seventy service pins were presented, signifying five, ten and twenty-five years of service, a total of more than four thousand, four hundred years. Harry S. Dolbey, Research Service Man; Albert B. Coulters, New England Representative; Peter Morrison, Pattern Maker; James B. Cook, Core Maker; Charles G. Richardson, Vice Pres. and Mgr. of Municipal Sales; and Thomas G. Healey, Foundry Foreman, received special congratulations, each having served over forty years.

HILL-HUBBELL is truly a pioneer name in the field of Steel Pipe Protection; pipeline engineers remember the introduction of our mill applied process 20 years ago.

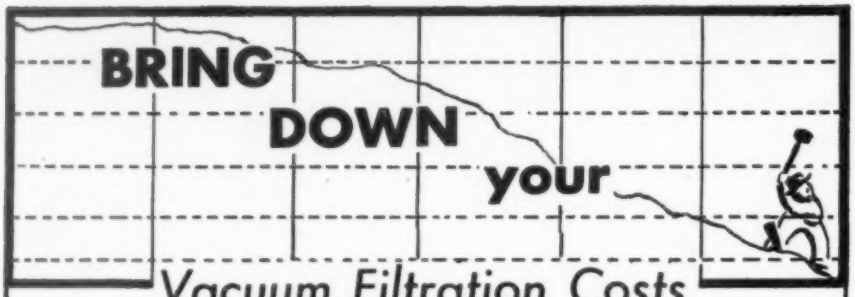
A W W A - 7A .6 Biturine Enameled steel pipe protection has set the pace in modern developments of plant engineered cleaning—priming—coating—wrapping—and—akwalining of steel pipe under controlled conditions to standard specifications.

**GENERAL PAINT CORPORATION**
HILL, HUBBELL & CO. • Division • Cleveland, Ohio
• EXPORT OFFICE: SAN FRANCISCO, CALIFORNIA, U. S. A. •

ANTHRAFILT
*A Filter Medium For All Purposes*
ANTHRACITE EQUIPMENT CORP.
101 Park Ave. New York
H. G. Turner Research Engineer
STATE COLLEGE, PA.

SAVE *with* TENNESSEE CORPORATION ferri-floc FERRIC SULPHATE
Write today for actual case histories of plants now using the ideal ferric coagulant.
TENNESSEE CORPORATION
Atlanta, Georgia Lockland, Ohio

SAVE MONEY USE ACTIVATED ALUM and BLACKALUM
STUART-BRUMLEY CORP.
516 North Charles St.
Baltimore Maryland




Vacuum Filtration Costs

with

ISCO Ferri-Cl$_3$or

FERRIC CHLORIDE

THE MODERN and EFFICIENT Coagulant

*Write for further information*

FERRIC CHLORIDE

INNIS, SPEIDEN & CO.

Established 1818

117 Liberty Street New York 6, N. Y.

BRANCHES • CHICAGO • CLEVELAND • PHILADELPHIA • BOSTON • GLOVERSVILLE, N. Y.


The employees of Builders turned about and presented the company with a Service Award in the form of a giant pin studded with five diamonds to commemorate one hundred twenty-five years of continuous service by the company. Henry S. Chaffee, President and Treasurer, accepted the award for the firm and presented the service pins to the employees. D. J. Purdie, of the New York Office, with thirty-three years service, acted as Toastmaster for the occasion.

## Dresser Establishes New Home Office in Cleveland

The Dresser Industries, Inc., formerly of Bradford, Pa., has opened a new centralized administrative office in the Terminal Tower in Cleveland, Ohio. Dresser Industries, Inc., now parent corporation of 13 companies with 18 plants, has nearly 6,000 sq. ft. of space in its new offices, with conference rooms, reception rooms, executive suites, and 14 offices for the staff. The new offices will provide a central location that will reduce executive travel time to the 18 different plants of the company.


A *Flexible* AIR SUPPLY

Plan now those future improvements in your Sewage Treatment plant. Plan, also, to profit from the experience of top-flight engineers—by specifying "Roots-Connersville Dual Impeller Blowers." Each unit offers you the capacity advantages of THREE separate and different size blowers, thus making it possible to vary the air supply to exactly meet changing demands. In addition, you profit from the compactness and economy of a SINGLE-UNIT installation. Write for Bulletin 23-B-12.

ROOTS - CONNERSVILLE BLOWER CORPORATION

*One of the Dresser Industries*

504 Mount Avenue

Connersville, Indiana

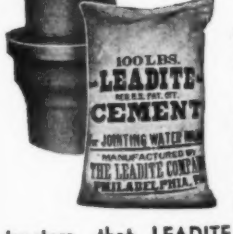
Unusual flexibility in air supply, with minimum power consumption, is obtained at North Carolina Sewage Disposal Plant with three "R-C" Dual Impeller Blowers (shown in photo). Each of these units has capacity of 650/1100/1750 CFM; pressure 7 lbs.

Roots CONNERSVILLE SINCE 1854 Aerating BLOWERS

LEADITE

The Pioneer Self Caulking Material for C I Pipe

"Time will tell"




And, in the case of LEADITE — *"Time has told"* . . . over 40 years of continuous use has proven to Water Works Men, Engineers and Contractors, that LEADITE not only makes a good tight joint, but *improves with age.*

*Write for Literature*

THE LEADITE COMPANY

Girard Trust Co. Bldg., Philadelphia 2, Pa.

No Caulking

## Woodson of Clow Expands Territory

John T. Woodson, formerly Southeastern Sales Manager for National Cast Iron Pipe Division of James B. Clow & Sons, Birmingham, Ala., has been appointed Southern Sales Manager and will serve both Southeastern and Southern territories.

Mr. Woodson, for many years connected with the Lynchburg Foundry Co., Lynchburg, Va., has been associated with National Cast Iron Pipe since 1940.

## LITERATURE AND CATALOGS

The first issue of Westinghouse's Newsfront will appear in April. This new monthly publication by the Westinghouse Electric and Manuf. Co. will be a four page report, printed in two colors and illustrated with drawings and photographs.

In the first issue there appears an article on a new application of the "Precipiton" air-cleaner for the removal of fly-ash. Perhaps some of these sewage plants with sludge incineration should also look into this unit. Future issues will contain other short articles on the latest achievements by the company in research, engineering, and production.

If you want to be placed on the mailing list let the Editor of "Westinghouse Newsfront," 306 Fourth Ave., Box 1017, Pittsburgh, Pa., know it and tell him we sent you.

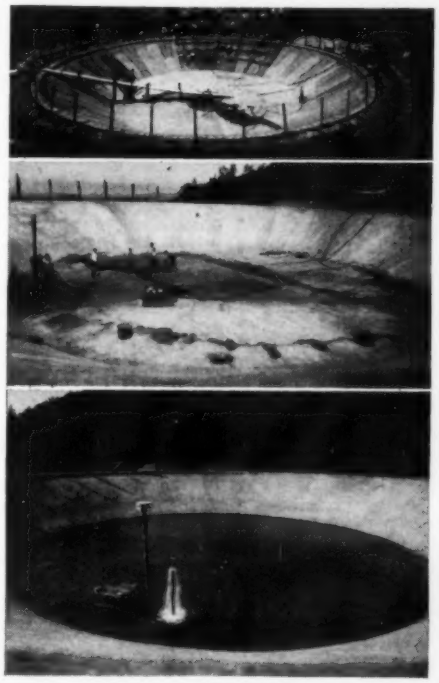

IMPROVED JOINTING COMPOUND

Tegul-MINERALEAD for Bell & Spigot Main

- Sulphur base; quick sealing, speeding laying and backfilling.
- 10 lb. ingot form, easily handled, stored and shipped. Impervious to rain. Cannot change composition.
- Makes permanently tight joints. Goes 3 to 5 times as far as lead, helping conserve a strategic war metal.
- For money-saving information, write

The ATLAS MINERAL Products Company of Pa.
Mertztown Pennsylvania

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.



LEAKAGE STOPPED WITH "GUNITE"!

This circular basin type reservoir of the Village of Bristol, Vermont was constructed originally with a concrete lining, which included a large number of radial and circumferential expansion joints. The reservoir leaked excessively.

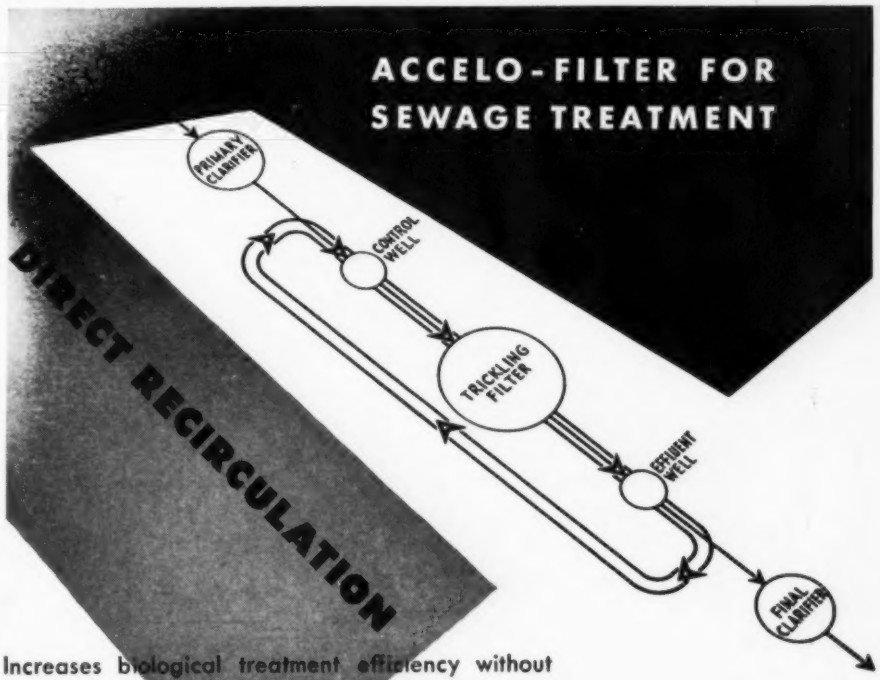
In 1934 we placed a reinforced "GUNITE" lining 2" thick in this reservoir, with no expansion joints in the "GUNITE." The leakage was stopped completely and the reservoir restored for many years of useful service.

The two upper photos show the work in progress and the lower photo the completed job.

**Write for our 74-page bulletin 2200 for complete information about "GUNITE."**

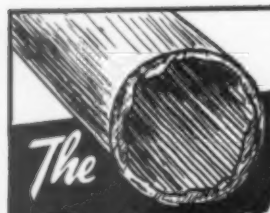
MANUFACTURERS OF THE "CEMENT GUN"

ACCELO-FILTER FOR SEWAGE TREATMENT



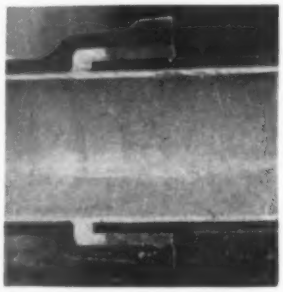

Increases biological treatment efficiency without necessitating any increase in size of either primary or final sedimentation tanks. *Ask for Bulletin 6200.*

INFILCO INFILCO INCORPORATED
325 W. 25TH PLACE, CHICAGO 16, ILL.



The TATE Cement Lining Process
Restores efficiency of old Water Mains

*Now* is the time to investigate the Tate Cement Lining process —and see what it can do to restore the efficiency of your old water mains.



View showing Tate Process in Pipe Joint. Note thoroughness of Lining.

*Write for Literature.*

**What the TATE Process accomplishes**

1. Water mains cleaned and cement-lined without removing pipe.
2. Eliminates discoloration and further cleaning costs.
3. Reduces pumping costs.
4. Restores reduction in head and flow co-efficients. This means full fire protection and lowered insurance rates.
5. All joints cement-lined . . . just one continuous pipe.
6. Does the job without interruption of service to consumer.

TATE PIPE LININGS, Inc.
ANDOVER, MASS.


When, on a recent occasion, we gave a lecture on Industrial Waste Disposal and mentioned the use of vibrating screens for the recovery of waste products in industrial plants, up popped one "Norm" Snyder, Buffalo representative of the Link-Belt company, and waved in front of our nose a copy of L-B's Book No. 1977, entitled **Link-Belt Liquid Vibrating Screen.**

We found this bulletin to contain not only a discussion of this method of separating solids and liquids, but also a series of pictures of installations in various and sundry types of industry. In one instance feed and fertilizer is reclaimed from tomato pulp, bean and pea canning wastes, whereas it formerly was a stream pollutant. Grease recovery, soy bean meal, beet refuse, cannery waste, rubber, grape pulp and citrus wastes are several other applications of these vibrating screens which apparently are part if not all of the answer to keeping unwanted solids out of sewers or receiving bodies of water. The bulletin, which may be had by writing Link-Belt Co. at Chicago, Philadelphia or any of its dozens of branch offices, also contains drawings and diagrams with dimensions of the various type screens.


# The Only 100% Self Propelling Sewer Cleaning Machine

Reduces Cleaning Time 75% to 80%

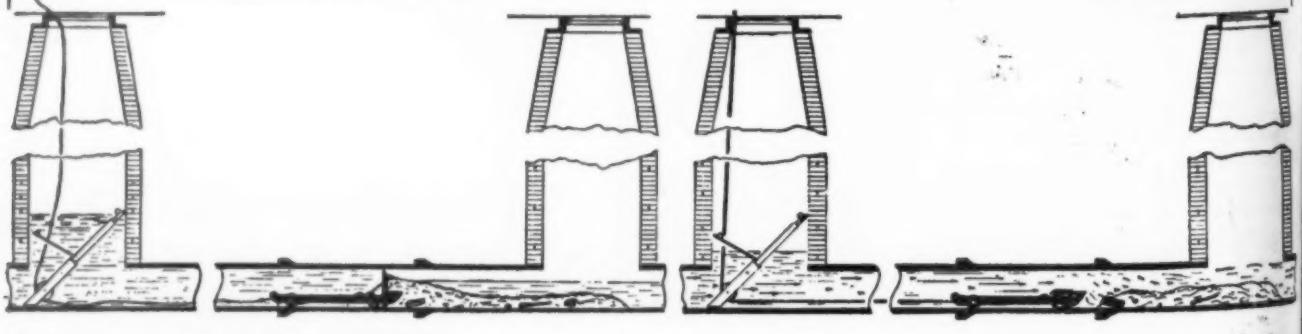
Your own maintenance men can restore your sewer lines to full capacity with this simple, sanitary and economical method. All work is done from the street level.

The Sewer Scooter is not pulled or pushed but the head pressure of the water in the line furnishes the motive power, often a six inch head is enough, but if the flow is small more water may be added. The CONTROLLED FLUSHING by the hinged, rubber edged shield as it progresses, removes all the accumulated sand, rocks and broken rods and leaves nothing behind. It Passes obstructions and plumbers taps and can be used as an emergency stopper during repairs.

**SEWER SCOOTER—**
**U. S. Patent 2198823**

**Sizes from 8" to 36" and larger on order**
**Write to us for detailed information**

## J. C. FITZGERALD
**Coral Gables 34, Fla.**



## Make Friends with the Public

*through*

# GOOD TASTING WATER

Water that tastes good to John Q. Public is the best public relations representative a water company can have. That's a good reason for using Hydrodarco.

Purification with this highly activated carbon means really good tasting water,—Hydrodarco removes bad taste, odors and impurities physically and permanently.

Try Hydrodarco for the right taste result at moderate cost.

HYDRODARCO

DARCO CORPORATION

60 East 42nd Street, New York 17, N. Y.

Hydrodarco: Reg. U. S. Pat. Off.


Because of the heavy demand for the previous edition of the **Classified Directory of Consulting Chemists and Chemical Engineers,** the 9th (1945) Edition has recently been issued. This Directory, published by the Association of Consulting Chemists and Chemical Engineers, Inc., contains 108 pages of information and a new key sheet and index. Seventy-nine consultants are listed by number. In the key sheet approximately 100 fields of chemical engineering and chemistry are listed alphabetically. From abrasives, acids and acoustics to x-rays, zinc metallurgy, and zinc rolling, each of the various categories has the key number of the consultants who specialize in the particular field as well as those who are qualified in that field. Sanitation, sanitary bacteriology, sedimentation, sewage and water, both industrial and sanitary, are of interest to our readers. This Classified Directory may be obtained by writing to the Assoc. of Cons. Chem. and Chem. Engrs., Inc., 50 E. 41st St., New York 17, N. Y.


## TYPE X SINGLE LID Meter Box COVERS

These modern covers for water meter settings have the Lifter Worm Lock plus a hinge-effect feature which permits the lid to be leaned back for meter reading, or lifted off if desired. Made in several sizes and depths.

*Write for catalog now.*

FORD Meter Box Co.

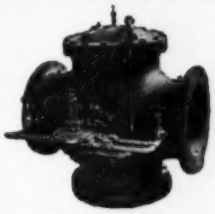
WABASH, INDIANA

· 1879 ·

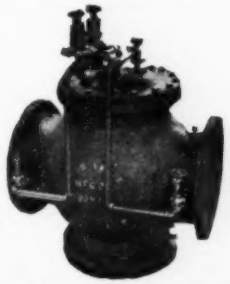
# ROSS AUTOMATIC VALVES

ALTITUDE VALVES • SURGE • RELIEF • BACK PRESSURE VALVES

FLOAT VALVES • REDUCING AND REGULATING VALVES



**ALTITUDE VALVES**
for
Control of elevation and heads into and out of tanks, basins and reservoirs, hydraulic control.
1. Single acting.
2. Double acting.
3. Combination assembly for three or more automatic operations.
4. Can be equipped with electric and manual controls.



**COMBINATION VALVE**
This valve will permit flow in one or both directions acting as
1. Pressure Reducing and Relief Valve.
2. Pressure Reducing and Altitude Valve.
3. Relief and Altitude Valve.

**REMOTE CONTROL VALVE**
Electric remote control—solenoid or motor can be furnished.
Adapted for use as primary or secondary control on any of the hydraulically controlled or operated valves.

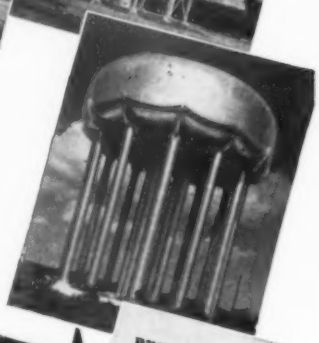
*"Blueprint Now!"*

ROSS VALVE MFG. CO.
INCORPORATED
P. O. BOX 595, TROY, N. Y.

TANK RUSTING PREVENTED *Electrically*

**Modern, service-proved Rusta Restor method . . . using safe, low voltages . . . gives lasting protection . . . for the cost of just one good paint job.**

● Engineered to the individual tank and water conditions, Rusta Restor the modern, cathodic (i.e. electrical) equipment maintains the tank in a "electro-negative" or "neutral" state that gives positive and lasting protection against rusting. Rusta Restor is modest in first cost and cheap to operate. Hundreds of installations from coast to coast are your assurance of efficient, reliable performance. Send for full details today.



Send for Catalog

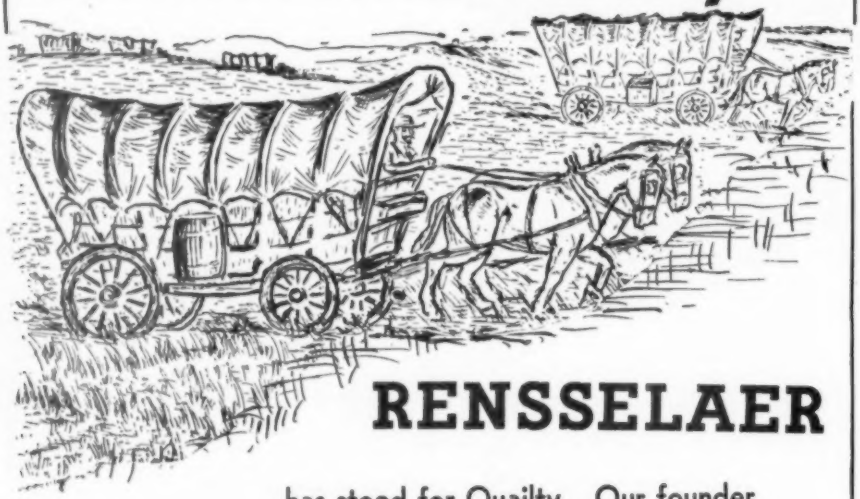
**RUSTA RESTOR**

*THE PROVEN CATHODIC (i. e. ELECTRICAL) RUST PREVENTIVE*
A DIVISION OF
**THE JOHNSTON AND JENNINGS COMPANY**
853 ADDISON ROAD • • • CLEVELAND 14, OHIO

OCECO VAPOR CONSERVATION AND FIRE PREVENTION EQUIPMENT FOR VOLATILE LIQUID STORAGE TANKS . . . STOWE STOKERS . . . HAMMERED FORGINGS



*Since Pioneer Days--*



**RENSSELAER**

has stood for Quailty. Our founder always insisted RENSSELAER Valves and Hydrants must be the best possible to produce. This same policy has been faithfully followed down to the present day.

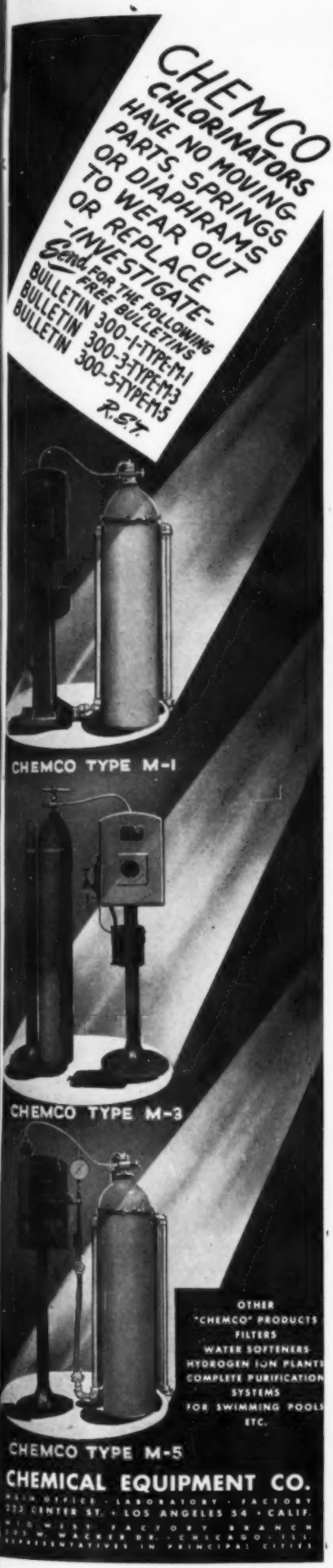
Ask the man who uses RENSSELAER

**RENSSELAER VALVE CO., TROY, N. Y.**


We're glad to see that Niagara Alkali's **Pioneer** is now printing the answers to its minute mysteries in the same issues as the mystery and this last issue also contains a couple of interesting items; one on chlorination of sewage effluents and another on water storage in tanks made of glass fabric. Of course, the latter is a war development, but who knows we may find some use for it after the holocaust is over. And then there is another little item on the "Bug Bomb." Keep your eye on the bug bomb, for it's going to be a big help to rid your plant of flies after the war. And if you want to keep up with things going on, keep your eye on the **Pioneer**, published by the Niagara Alkali Co., 60 E. 42nd St., New York 17, N. Y.

For drainage, flood water, effluent, boiler blow-off, hot wells, alkalies and acids, you might want to consider Yeomans' automatic electric **Heavy Duty Bilge or Sump Pumps,** as described in Bulletin 3003. In addition to information on the bilge pumps in the bulletin, there is material on control apparatus, dewatering pumps for construction work, gasoline and Diesel engine driven units, special centrifugal drainage pumps, deep-pit drainage pumps, "Skip-Pit" sump pumps (where there is an unusual amount of grit, ash, or abrasive material), and pumps for chemical and process industries. Also included in the bulletin are tables on how to select bilge pumps. Bull. 3003 may be obtained from Yeomans Bros. Co., 1433 N. Dayton St., Chicago, Ill.

While we are talking about postwar planning and *Blueprint Now*, it is comforting to know that at least one company (we have no doubt there are many others) has a postwar plan for "When It's Over, Over There." This is the title of an article in **Johns-Manville News Pictorial** for March 15, an article which tells J-M's plan for handling its returning war veteran employees. This plan, which may be of interest to other business men as well as municipal employers, is already in operation. While we can't explain it here, we can say that it sounds reasonable, workable, and forthright. No doubt you can





obtain a copy of this semi-monthly magazine distributed to J-M employees if you will write to Johns-Manville Corp., 22 East 40th St., New York 16, N. Y.

"The history of chlorination in sewage treatment parallels that of many other technical discoveries in that it was first introduced to perform a specific function and subsequently developed for additional uses." Thus reads the first paragraph of **"Applications of Chlorine in Sewage Treatment,"** Technical Publication 243 of Wallace and Tiernan Co.

With disinfection as a starting point, the bulletin lists and discusses the use of chlorine in sewage plants, for odor control; corrosion and concrete disintegration control; B.O.D. reduction; to control foaming, conditioning of supernatant liquor; correction of sludge bulking in activated sludge plants (see article by Kin elsewhere in this issue); as an adjunct to chemical precipitation; and for grease removal and trade waste control. In addition to all this, the bulletin includes a diagram showing the points of application for all of these functions in a complete


BLUE PRINT NOW
for
SEWAGE TREATMENT PLANTS
and
WATER TREATMENT PLANTS

* * *

Send for Aero-filter Bulletin 112 for Sewage Plants.

Low initial cost.

Low operating cost.

*Send for Water Treatment Bulletin 36.*

LAKESIDE ENGINEERING CORPORATION
222 W. Adams St. Chicago 6, Ill.



EDDY
FIRE HYDRANTS
AND VALVES—
WATER WORKS EQUIPMENT

EDDY VALVES
For
Water Works
and
Sewage Disposal
Plants

EDDY FIRE HYDRANTS
For Fire Protection Service

*Write for Complete Catalog*

Eddy
VALVE COMPANY
WATERFORD, N. Y.

treatment trickling filter plant, as well as pictures of installations, and several types of chlorinators for sewage plants.

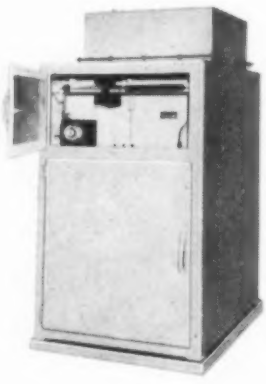
Another item from the Technical Service Division of W&T is a reprint (No. RA-1038) of an article entitled **"Chlorination Corrects Filter Pooling"** by W. Winfield, Supt. of Sewage Treatment at Rotterdam, N. Y.

If you read the ads. in *Water Works and Sewerage* — and you should—you have probably noticed the Royer Foundry and Machine Co. slogan of **"Profits from Sewage Sludge."** That is not only a slogan, it is also the title of the new Bulletin 643 of the company which makes (and shows in this bulletin) "A Royer for every sewage plant requirement." Out of a dozen models shown you can no doubt pick one that will meet your needs as to capacity, drive, power, height, width and length, or any other specification you might have. This bulletin, which you may obtain by writing Royer at 165 Pringle St., Kingston, Pa., also contains information on the use of the sludge grinders for Victory Gardens, parks, golf courses, and at schools and institutions.


do your plans call for a gravimetric feeder?

Specify an OMEGA "LOSS-IN-WEIGHT"

Without a doubt, the most accurate type of chemical dry feeder . . . weighs, feeds and records within 1% of rate set on feed dial, bringing laboratory accuracy to plant scale treatment. Successfully handles Ferrisul and such hygroscopic chemicals. Write for Bulletin.



Omega "Loss-in-Weight" Gravimetric Feeder

OTHER OMEGA PRODUCTS

Volumetric Feeders
Solution Feeders
Lime Slaking Equipment
Mechanical Agitators
Bucket Elevators
Laboratory Stirrers

Bulletins on Request

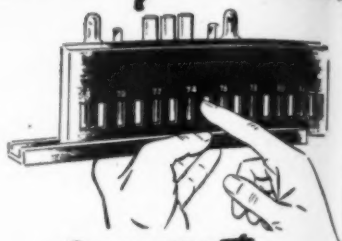
Sincerely

OMEGA MACHINE CO.
(Division of Builders Iron Foundry)

9N CODDING ST., PROVIDENCE 1, R. I.



"Here's Your Answer"



Accurate pH and CHLORINE DETERMINATIONS IN 3 EASY STEPS WITH TAYLOR COMPARATORS

ACCURACY IS ASSURED FOR ALL TAYLOR LIQUID COLOR STANDARDS CARRY AN UNLIMITED GUARANTEE AGAINST FADING.

FREE TO WATER WORKS AND SEWAGE DISPOSAL PLANTS — 83-page book describing modern methods—facts—outfits and determination procedures. Ask your dealer or WRITE direct for your free copy. Taylor Comparators—complete up. Water Analyzer $18.00.

W. A. TAYLOR CO.
7308 YORK RD. • BALTIMORE-4, MD.



"Bob White"
ELECTRONIC BOX LOCATOR

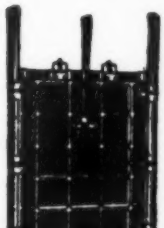
- Will locate curb and street boxes as fast as you can walk.
- Locates de-magnetized boxes where dipping needle fails.
- Finds boxes in the dark without a flashlight.

(Also Pipe Locators and Leak Detectors)

S. F. FERGUSON
11 HILL STREET, NEWARK 2, N. J.



RODNEY HUNT



GATES and HOISTS

Metal or timber sluice gates of all sizes and designs, approved by engineers everywhere. Improved gate stands and hoists for hand or motor operation. Also flap and mud valves, shear and filler gates, trash racks and rakes. Dependable canal equipment from dam to tail-race since 1840.

*Write for Special Catalog Today!*

RODNEY HUNT

RODNEY HUNT MACHINE CO.
118 Lake St., Orange, Mass., U. S. A.

FOR SALE—PIPE

12,500 ft. 24" Class 150 cast iron Bell & Spigot pipe 16 ft. lengths. New-Surplus stock shipment.

SONKEN-GALAMBA CORP.
Kansas City 18, Kansas

FOR SALE: One 100 H.P. 3 cylinder, WORTHINGTON NATURAL GAS or SEWAGE GAS ENGINE. This engine is in good condition and ready for immediate shipment. Also one 60 KW, 220 volt AC GENERATOR. Write or wire E. A. Woodard, % Sioux Falls Rendering Company, Sioux Falls, South Dakota.

ENGINEER WANTED

By newly organized Water Softener and Filter Manufacturer located in Middlewest. Our sales are now on a national basis and we have an exceptional opportunity to offer the right man. Must be thoroughly acquainted with all phases of water conditioning. Salary in accordance with ability. Write giving full details for confidential interview to

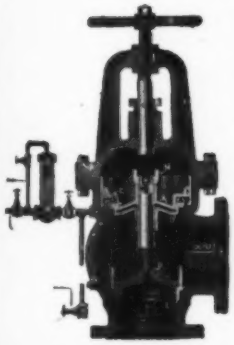
Box 1004

Water Works & Sewerage
330 So. Wells Street,
Chicago 6, Illinois

Triple-Acting Non-Return Valve

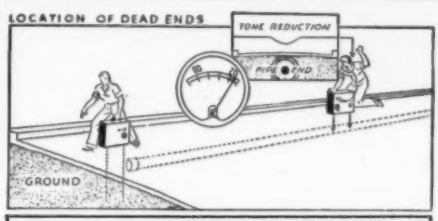
This valve will automatically cut in a boiler whenever its pressure equals line-header pressure; it will isolate a boiler automatically whenever its pressure, from any cause, is lower than line-header pressure; and it will prevent steam flow from the boiler in event of sudden drop of line-header pressure below the boiler pressure, by means of differential shot pilot valve functioning.

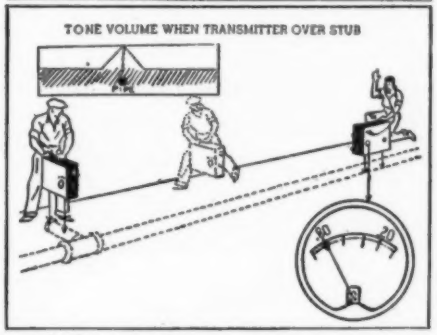
*Write for specifications.*



Furnished in angle, globe and elbow patterns, sizes 2½" to 12"; also available in larger sizes, as well as in the Cross pattern.

GOLDEN-ANDERSON VALVE SPECIALTY CO.
Fulton Building Pittsburgh, Pa.




M-SCOPE
Buried Pipe Finder and Leak Detector

FREE 16 PAGE BOOKLET UPON REQUEST

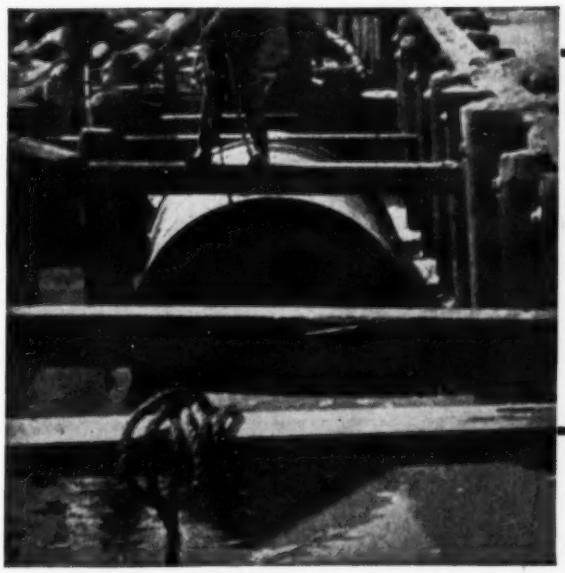
The M-SCOPE consists of a specially designed radio Transmitter and Receiver, with conductive wire. In operation, the Transmitter sends out a continuous signal, and when there is no metal between Transmitter and Receiver, a definite volume of sound is heard in the Receiver earphones and the meter (mounted on Receiver) gives a definite reading. If a metal object lies between the two units, sound in earphones is louder and meter reading higher—and the pipe or other metal object is located.

*The M-SCOPE is solving — successfully — the varied problems involved in the development, operation and maintenance of buried pipe and cable systems and is in daily use by representative organizations in such important groups as:*

- Government Projects
- Municipalities
- Sewerage and Water Plants
- Consulting Engineers
- Airports
- Public Utilities
- Industrial Plants
- Iil and Pipeline Companies

*Write for further particulars and booklet:*

FISHER RESEARCH LABORATORY
*Direct Teletype* PALO ALTO, CALIFORNIA



84" pipe—Spring Lake, N. J.

FLANGED PIPE
FLEXIBLE JOINT PIPE
BELL & SPIGOT PIPE
SPECIAL CASTINGS
SHORT BODY BELL & SPIGOT SPECIALS

*Large stock enables us to make prompt shipments.*

CAST IRON PIPE

SIZES 2" TO 84"

Warren Foundry & Pipe Corp.
11 Broadway, New York

Warren Pipe Company of Mass., Inc.

# Consulting Engineers

*Specializing in the field of*

**WATER WORKS & SEWERAGE**

## ALBRIGHT & FRIEL, INC.

*Consulting Engineers*

Water, Sewage and Industrial Waste Problems — Airfields, Refuse Incinerators, Power Plants — Industrial Buildings
City Planning - Reports - Valuations

Laboratory

1520 Locust Street, Philadelphia 2

## Alvord, Burdick & Howson

*Engineers*

Charles B. Burdick
Louis R. Howson
Donald H. Maxwell

Water Works, Water Purification, Flood Relief, Sewerage, Sewage Disposal, Drainage, Appraisals, Power Generation

Civic Opera Building — Chicago

## Michael Baker, Jr.

*The Baker Engineers*

CIVIL ENGINEERS AND PLANNERS
MUNICIPAL ENGINEERS

Airport Design—Sewage Disposal Systems
Water Works Design and Operation
Consulting Services - Surveys and Maps

HOME OFFICE—ROCHESTER, PA.

## Black & Veatch

*Consulting Engineers*

4706 Broadway, Kansas City, Mo.

Sewerage, Sewage Disposal, Water Supply, Water Purification, Electric Lighting, Power Plants, Valuations, Special Investigations, Reports and Laboratory Service

E. B. Black — N. T. Veatch, Jr.
A. P. Learned — H. F. Lutz
F. M. Veatch — R. E. Lawrence
E. L. Filby — J. F. Brown

## Clinton L. Bogert

*CONSULTING ENGINEER*

WATER SUPPLY AND PURIFICATION
SEWERAGE AND SEWAGE DISPOSAL

Timber, Steel and Reinforced Concrete Structures

624 Madison Avenue
New York City 22

## Buck, Seifert and Jost

*Consulting Engineers*

(Formerly Nicholas S. Hill Associates)

Water Supply, Sewage Disposal, Hydraulic Developments, Reports, Investigations, Valuations, Rates, Design Construction Operation, Management, Chemical and Biological Laboratories

112 East 19th St. — New York

## Burns & McDonnell

Engineering Co.

McDONNELL-SMITH-BALDWIN-TIMANUS-McDONNELL

*Consulting Engineers Since 1897*

Waterworks, Light and Power, Sewerage, Reports, Designs, Appraisals, Rate Investigations

Kansas City, Mo., 107 West Linwood Blvd.

## THOMAS R. CAMP

*Consulting Engineer*

6 Beacon Street, Boston 8, Mass.

Water Works and Water Treatment; Sewerage and Sewage Treatment; Municipal and Industrial Wastes; Investigations and Reports; Design and Supervision; Research and Development; Flood Control.

## The Chester Engineers

Campbell, Davis & Bankson

Water Supply and Purification, Sewerage and Sewage Treatment, Power Development and Applications, Investigations and Reports, Valuations and Rates.

210 E. Park Way at Sandusky,
Pittsburgh 12, Pa.

## Collins Engineering Company

—Consulting Engineers—

Water Supply, Purification, Sewerage, Sewage Treatment, Refuse Disposal, Industrial Wastes, Street Paving, Storm Drainage

326 Arnote Building — 314 Gilbert Building
McAlester, Oklahoma — Ardmore, Oklahoma

## DE LEUW, CATHER & COMPANY

Water Supply — Sewerage
Railroads — Highways
Grade Separations—Bridges—Subways
Local Transportation

Investigations — Reports — Appraisals
Plans and Supervision of Construction

20 North Wacker Drive — Chicago

## FAY, SPOFFORD & THORNDIKE

Engineers

Charles M. Spofford
John Ayer — Carroll A. Farwell
Bion A. Bowman — Ralph W. Horne

Water Supply and Distribution — Drainage
Sewerage and Sewage Treatment—Airports

Investigations and Reports
Designs — Valuations
Supervision of Construction

Boston — New York

## S. F. Ferguson

Water Leak Surveys
Distribution Maps

11 Hill Street, Newark 2, N. J.

## Edward A. Fulton

*Consulting Engineer*

Investigations, Reports, Valuations, Design and Construction—Water Supply and Purification Plants, Sewerage and Sewage Treatment Works; Municipal Paving and Power Developments.

3 So. Meramac Ave.
St. Louis, Mo.

## Gannett, Fleming, Corddry & Carpenter, Inc.

*Engineers*

Harrisburg, Penna.

Preparation of
POST WAR REPORTS and PLANS

## I. M. Glace

*Consulting Sanitary Engineer*

WATER SUPPLY AND PURIFICATION
SEWERAGE AND SEWAGE TREATMENT

Specializing in Water Quality Problems

Telephone 3-2839 — 22nd and Market Sts. Harrisburg, Pa.

## Greeley and Hansen

*Engineers*

Samuel A. Greeley — Paul Hansen
Paul E. Langdon — Kenneth V. Hill
Thomas M. Niles — Samuel M. Clarke

Water Supply, Water Purification, Sewerage, Sewage Treatment, Flood Control, Drainage, Refuse Disposal

6 N. Michigan Ave., Chicago

## Havens and Emerson

W. L. Havens — C. A. Emerson
A. A. Burger — F. C. Tolles — F. W. Jones

*Consulting Engineers*

Water, Sewage, Garbage, Industrial Wastes, Valuations — Laboratories

Leader Building, Cleveland 14 — Woolworth Bldg. New York 7

## Hayden, Harding & Buchanan

*Consulting Engineers*

John L. Hayden — Gordon E. MacNeill
John H. Harding — Oscar J. Campia

Waterworks, Sewerage, Civil, Mechanical, Electrical, Structural

662 Park Square Building, Boston, Mass.

## Charles Haydock

Consulting Engineer

Water Works and Sanitation, Industrial Wastes, Design, Construction, Operation and Management. Reports and Valuations.

COMMERCIAL TRUST BUILDING
PHILADELPHIA 2

## JONES & HENRY

Formerly H. P. JONES & CO.

Harvey P. Jones — Thomas B. Henry

*Consulting Engineers*

Reports, Designs, Supervision, Valuation

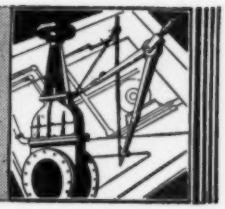
Water Supply — Refuse Disposal
Water Purification — Industrial Wastes
Sewerage — Flood Control
Sewage Treatment — Drainage

606 Toledo Trust Bldg. — Toledo 4, Ohio

# Consulting Engineers

*Specializing in the field of*

**WATER WORKS & SEWERAGE**



## Morris Knowles, Inc.

***Engineers***

Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning

**1312 Park Building, Pittsburgh, Pa.**

## Wm. S. Lozier, Inc.

***Consulting Engineers***

Wm. S. Lozier - C. E. Elmdorf - A. B. Squire
Sewerage, Sewage Disposal, Water Supply, Water Purification, Refuse Disposal

**10 Gibbs Street, Rochester, N. Y.**

## Metcalf & Eddy

***Engineers***

Water, Sewage, Drainage, Refuse and Industrial Waste Problems
Airfields Valuations
Laboratory

**Statler Building, Boston**

## MURRAY LABORATORY

25 years experience

**Consulting—Analytical—Chemist—Bacteriologist. Municipal and Industrial Water Supplies**

Bacteriological — Chemical — Sanitary — Mineral Analyses. Reports and Treatment Recommendations.

**Capers Bldg.—Greenville, South Carolina**

## Nussbaumer and Clarke

**Newell L. Nussbaumer** **Irving Clarke**

Water Supply and Treatment
Sewerage & Sewage Disposal
Garbage Incineration
Town Planning

**327 Franklin St.** **Buffalo, N. Y.**

## Parsons, Brinckerhoff, Hogan & Macdonald

Formerly: Parsons, Klapp, Brinckerhoff & Douglas

***Engineers***

Traffic Reports Valuations Harbor Works
Power Developments Industrial Buildings
Bridges Tunnels Subways Foundations
Dams Water Works Sewerage

**142 Maiden Lane, New York 7**
**Calle Sur 17 No. 27, Caracas, Venezuela**
**Avenida Presidente Wilson 164, Rio de Janeiro, Brazil**

## Malcolm Pirnie

***Engineers***

Water Supply, Treatment, Sewerage
Reports, Plans, Estimates
Supervision and Operation
Valuation and Rates

**25 W. 43rd St., New York, N. Y.**

## The Pitometer Company

***Engineers***

**Water Waste Surveys, Trunk Main Surveys, Water Distribution Studies**

**Penstock Gaugings**
**New York, 40 Church St.**

## ROBERT T. REGESTER

***Consulting Engineer***

Sewerage—Sewage Treatment
Water Works—Industrial Wastes
Flood Control—Fire Protection

Advisory Service, Reports and Designs

**Baltimore Life Building**
**Baltimore, Md.**

## Thomas M. Riddick

***Consulting Engineer and Chemist***

Municipal and Industrial Water Purification, Sewage Treatment, Operating Supervision of Plants, Sanitary Surveys, Stream Pollution Investigation, Swimming Pool Control, Chemical and Bacteriological Analyses, Testing of Materials.

**369 East 149th Street, New York City**

## ROBERT AND COMPANY

Incorporated

*Architects and Engineers*

ATLANTA, GEORGIA

Water Supply Incinerators
Sewage Disposal Power Plants

## Russell & Axon

Geo. S. Russell—John C. Pritchard
Joe Williamson, Jr. — F. E. Wenger

***Consulting Engineers, Inc.***

Sewerage, Sewage Disposal, Water Works, Filtration, Softening
Power Plants

**6635 Delmar Blvd University City 5, Mo.**

## J. E. Sirrine & Company

***Engineers***

Water Supply & Purification
Sewage & Industrial Waste Disposal
Stream Pollution Reports
Utilities, Analyses

**Greenville** **South Carolina**

## Benjamin L. Smith & Associates

***Engineers***

**(Formerly Whitman and Smith)**

Investigations — Reports
Designs — Supervision — Valuations
Municipal Engineering and Public Utilities

**11 North Pearl Street**
**Albany 7, New York**

## STANLEY ENGINEERING COMPANY *Consulting Engineers*

Water Works — Sewerage
Electric Power — Flood Control
Rate Studies—Valuations—Industrial
Airports . . . Municipal Buildings

**Central State Bank Bldg., Muscatine, Ia.**

## CONSULTING ENGINEERS

*Directory Service*

Place your professional card in this Directory of Consulting Engineers where it will be seen when the readers are seeking your services. Rates nominal. Write—

**Water Works & Sewerage**

**330 S. Wells St., Chicago 6, Ill.**

## Westcott & Mapes, Inc.

***Architects and Engineers***

Sewage Disposal
Garbage and Refuse Incineration
Public Utilities
Reports Plans Specifications

**NEW HAVEN** **CONN.**

## Weston & Sampson

Water Supply, Water Purification, Sewerage, Sewage and Industrial Waste Treatment, Corrosion Control, Laboratory Service, Supervision, Valuations

**14 Beacon St.** **Boston, Mass.**

## Whitman & Howard

***Engineers (Est. 1869—Inc. 1924)***

Channing Howard Paul F. Howard
Walter A. Janvrin C. Roger Pearson

Water Supply, Water Purification, Sewerage, Sewage Disposal, Water Front Improvements and all Municipal and Industrial Development Problems, Investigations, Reports, Designs, Supervision, Valuations.

**89 Broad St., Boston, Mass.**

## BUY MORE WAR BONDS

## "Good Makings"
### Make a Good Water System

You can always put your utmost confidence in a Layne Well Water System. Everything from the method used in drilling and finishing the well to the design, manufacture and installation of the pump can be trusted for highest efficiency, most durable quality and the longest life of service.

Shown above is a system recently completed for a major food manufacturer. Running true to Layne form, this system out performs its guarantee, producing nearly twice as much water as other wells in the same locality. This manufacturer knew what to expect. He already owns four other Layne Well Water Systems, all of which have always given outstanding service. He knows how little it costs to operate Layne Systems, how much water these systems produce and how small the upkeep cost.

Layne is already in postwar work. Many postwar installations are now being made. Others will soon be started. All will be of the world famous Layne quality.

If you need more water, either from entirely new wells and pumps, or from efficiently modernized old ones, write, wire or phone for the planning and estimating services of a Layne engineer. No obligation. Address Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

***LAYNE PUMPS** — fulfill every need for producing large quantities of water at low cost from wells, streams, mines or reservoirs. Send for literature.*

**AFFILIATED COMPANIES:** Layne-Arkansas Co., Stuttgart, Ark. * Layne-Atlantic Co., Norfolk, Va. * Layne-Central Co., Memphis, Tenn. * Layne-Northern Co., Mishawaka, Ind. * Layne-Louisiana Co., Lake Charles, La. * Louisiana Well Co., Monroe, La. * Layne-New York Co., New York City * Layne-Northwest Co., Milwaukee, Wis. * Layne-Ohio Co., Columbus, Ohio * Layne-Texas Co., Houston, Texas * Layne-Western Co., Kansas City, Mo. * Layne-Western Co. of Minnesota, Minneapolis, Minn. * International Water Supply Ltd., London, Ontario, Canada * Layne-Hispano Americana, S. A., Mexico, D. F.

LAYNE

**WELL WATER SYSTEMS**
**VERTICAL TURBINE PUMPS**


# Index TO ADVERTISERS


Albright & Friel, Inc. ..... 98
Allen Billmyre Co. ..... 77
Alvord, Burdick & Howson ..... 98
American Brass Co. ..... 28
American Car & Fdry. Co. ..... 32
American Cast Iron Pipe Co. ..... 81
American Radiator & Standard Sanitary ..... 87
American Well Works ..... 10
Anthracite Equipment Co. ..... 89
*Atlas Mineral Products Co. of Pa., The ..... 91
Audel, Publishers ..... 83
Aurora Pump Co. ..... 83

Badger Meter Mfg. Co. ..... 33
*Bailey Meter Co. ..... 83
Baker, Jr., Michael ..... 98
Black & Veatch ..... 98
Bogert, Clinton L. ..... 98
Bridgeport Brass Co. ..... 27
Buck, Seifert and Jost ..... 98
Buffalo Gasolene Motor Co. ..... 80
*Builders Iron Foundry ..... 17
*Builders-Providence, Inc. ..... 17
Burgess-Manning Co. ..... 18
Burns & McDonnell ..... 98
Byers Co., A. M. ..... 21

*Calgon, Inc. ..... 29
Camp, Thos. R. ..... 98
Carter Co., Ralph B. ..... 25
Cast Iron Pipe Research Assn. ..... 13
Chain Belt Co. ..... 82
Chemical Equipment Co. ..... 95
Cement Gun Co. ..... 91
Chester Engineers, The ..... 98
*Chicago Bridge & Iron Co. ..... 7
*Chicago Pump Company ..... 3
Clayton Mfg. Co. ..... 76
Collins Engineering Co. ..... 98
Cook, Inc., A. D. ..... 78
Cooper-Bessemer Corp. ..... 34

Darco Corp. ..... 93
Dayton-Dowd Co. ..... 81
De Laval Steam Turbine Co. ..... 23
DeLeuw, Cather & Co. ..... 98
Diamond Alkali Company ..... 11
Dorr Company, Inc., The ....Third Cover

Eddy Valve Company ..... 95
Edson Corporation, The ..... 83
Electro Rust Proof Corp. ..... 83

Fay, Spofford & Thorndike ..... 98
*Ferguson, S. F. ..... 96-98
Fibre Conduit Co., The ..... 88
Fisher Research Laboratory ..... 97
Fitzgerald, J. C. ..... 92
*Flexible Sewer Rod Equipment Co. ..... 77
*Flexible Underground Pipe Cutting Co. ..... 77
Ford Meter Box Co. ..... 93
Fulton, Edward A. ..... 98

Gannett, Fleming, Cordry & Carpenter, Inc. ..... 98
Ceneral Chemical Co. ..... 16
General Electric ..... 4-5
*General Paint Corp. ..... 89
Glace, I. M. ..... 98
*Golden-Anderson Valve Spec. Co. ..... 97
Grancell, I. H. ..... 76
Greeley & Hansen ..... 98
Grinnell Co. ..... 85

Havens & Emerson ..... 98
Hayden, Harding & Buchanan ..... 98
Haydock, Chas. ..... 98
Hays Mfg. Co. ..... 75
*Hellige, Inc. ..... 88
Homelite Corp. ..... 12
Hooker Electro Chemical Co. ..... 79
Hydraulic Development Corp. ..... 88

*Industrial Chemical Sales ..... 9
*Infilco, Incorporated ..... 91
*Innis, Speiden & Co. ..... 90
Iowa Valve Co. ..... 78

Johns-Manville ..... 31
Johnston & Jennings Co. ..... 94
Jones & Henry ..... 98

Knowles, Inc., Morris ..... 90

Lakeside Engr. Corp. ..... 95
Layne and Bowler, Inc. ..... 100
Leadite Company ..... 90
Leopold Co., Inc., F. B. ..... 96
Lock Joint Pipe Co. ..... 15
Lozier, Inc., Wm. S. ..... 89

Mathews Hydrants ..... 94
Mathieson Alkali Wks., Inc. ..... 6
Metcalf & Eddy ..... 98
Mueller Co. ..... 97
Murray Laboratory ..... 89

National Clay Pipe Mfrs., Inc. ..... 74
Neptune Meter Company ..... 35
Niagara Alkali Co. ..... 19-20
Nussbaumer & Clarke, Inc. ..... 98

Omega Machine Co. (Division of Builders Iron Fdry.) ..... 96

*Pacific Flush-Tank Company ..... 81
Parsons, Brinckerhoff, Hogan & Macdonald ..... 98
Peerless Pump Division (Food Machy. Corp.) ..... 72
*Pennsylvania Salt Mfg. Company ..... Second Cover
*Permutit Co., The ..... 75
Phipps & Bird, Inc. ..... 87
Pirnie, Malcolm ..... 98
Pitometer Co., The ..... 98
Pittsburgh-Des Moines Steel Company ..... 22
Pittsburgh Equitable Meter Company 74
*Proportioneers, Inc. ..... 94

Regester, Robt. T. ..... 98
Rensselaer Valve Co. ..... 94
Riddick, Thomas M. ..... 98
Ridge Tool Co. ..... 79
Robert and Co. ..... 98
Roberts Filter Mfg. Co. ..... 94
Rodney Hunt Mach. Co. ..... 96
Roots Connersville Blower Corp. ..... 93
*Ross Valve Mfg. Company ..... 92
Royer Fdry. & Mach. Co. ..... 24
Russell & Axon ..... 98
Rusta Restor (Div.) ..... 94

Simplex Valve & Meter Co. ..... 30
Sirrine & Company, J. E. ..... 98
Smith & Associates, Benj. L. ..... 98
Smith Co., S. Morgan ..... 26
Smith Mfg. Co., The A. P. ..... 87
*Sparling, R. W. ..... 86
Stanley Engineering Company ..... 98
Stuart-Brumley Corp. ..... 80

Tapax Mfg. Co., Inc. ..... 94
Tate Pipe Linings, Inc. ..... 92
Taylor & Co., W. A. ..... 96
*Tennessee Corp. ..... 88
Thomson Meter Company ..... 33
Turbine Equipment Co. ..... 8

U. S. Pipe & Fdry. Co. ..... 25

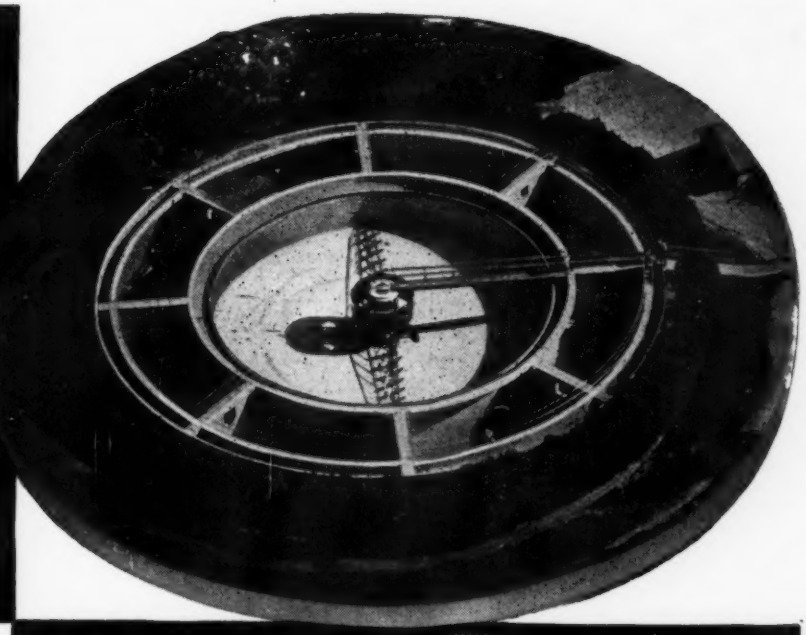
Vogt Brothers Manufacturing Co. ..... 81
Vogt Manufacturing Co. ..... 81

*Wallace & Tiernan Co., Inc. ..Back Cover
Warren Foundry & Pipe Corp. ..... 97
Westcott & Mapes, Inc. ..... 98
Weston, L. A. ..... 86
Weston and Sampson ..... 98
Whitman and Howard ..... 98
*Wilson Chemical Feeders, Inc. ..... 80
Wood Company, R. D. ..... 84
*Worthington-Gamon Meter Co. ..... 14

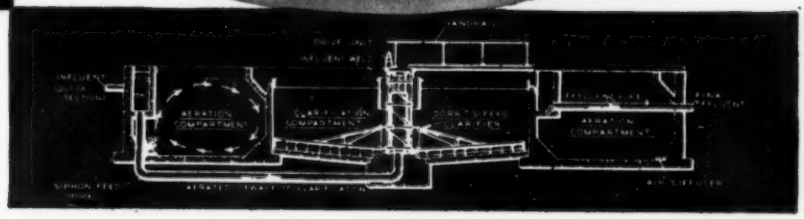
Zeolite Chemical Co. ..... 82


*Advertisers with * were represented in the June, 1944, Convention and Data Edition with catalog specification copy. Please refer to that issue for additional information on behalf of their products.

# ACTIVATED SLUDGE PROCESSING For Small Municipalities



CURRIE CLARAETOR AT PASADENA, CALIFORNIA



The Currie Claraetor, a combination unit providing clarification and aeration in a single tank, brings the Activated Sludge Process within the means of small municipalities with populations ranging from 5,000 to 15,000 and upwards.

In all cases the Currie Claraetor will give results comparable with those obtained in large plants where clarification and aeration take place in separate tanks.

The initial and operating cost of a small Activated Sludge Plant of this type is generally less than for a small plant of equivalent capacity of the conventional multiple tank design.

The Currie Claraetor may also be used as a Pre-aeration unit. The raw sewage will pass through the aeration compartment and into the Clarifier for sedimentation.

## HOW IT WORKS

The Currie Claraetor consists of a circular tank divided by an inner concentric ring into two separate compartments. The outer compartment is the Aeration Compartment and the inner is used for Clarification and is similar to the conventional tank used with Dorr Clarifiers.

Aeration may be either by straight air diffusion through porous tile, by mechanical means, or by a combination of the two. Sedimentation is accomplished by a Dorr Sifeed Clarifier, if the sedimentation compartment is circular. A Dorr Squarex Clarifier is used if the sedimentation compartment is square.

## ADVANTAGES

***Compactness:*** The Currie Claraetor is complete, self-contained Activated Sludge plant in a single tank.

***Low Initial Cost:*** Installation cost is less than for separate Aerators and Clarifiers with equivalent capacity and flexibility.

No outside conduits are required, as in separate tank installations.

Lower side distribution channel serves also as an air deflector in case of diffused aeration.

***Efficiency:*** Short circuiting is eliminated in aeration compartment by multiple-chamber construction with dividing walls.

***Flexibility:*** One or more aeration chambers may be removed from service without interrupting plant operation. Various tank shapes and arrangements are permissible.

*For more details and operating data on the Currie Claraetor, write for Bulletin No. 6581-C*

7932

DORRCO

**THE DORR COMPANY, ENGINEERS**

NEW YORK 22, N. Y. . . 570 LEXINGTON AVE.
ATLANTA 3, GA. . . WILLIAM-OLIVER BLDG.
TORONTO 1, ONT. . . . 80 RICHMOND ST. W.
CHICAGO 1, ILL. . . . . 221 NO. LA SALLE ST.
DENVER 2, COLO. . . . . COOPER BUILDING
LOS ANGELES 14, CAL. . . . 811 WEST 7TH ST.

RESEARCH AND TESTING LABORATORIES
WESTPORT, CONN.

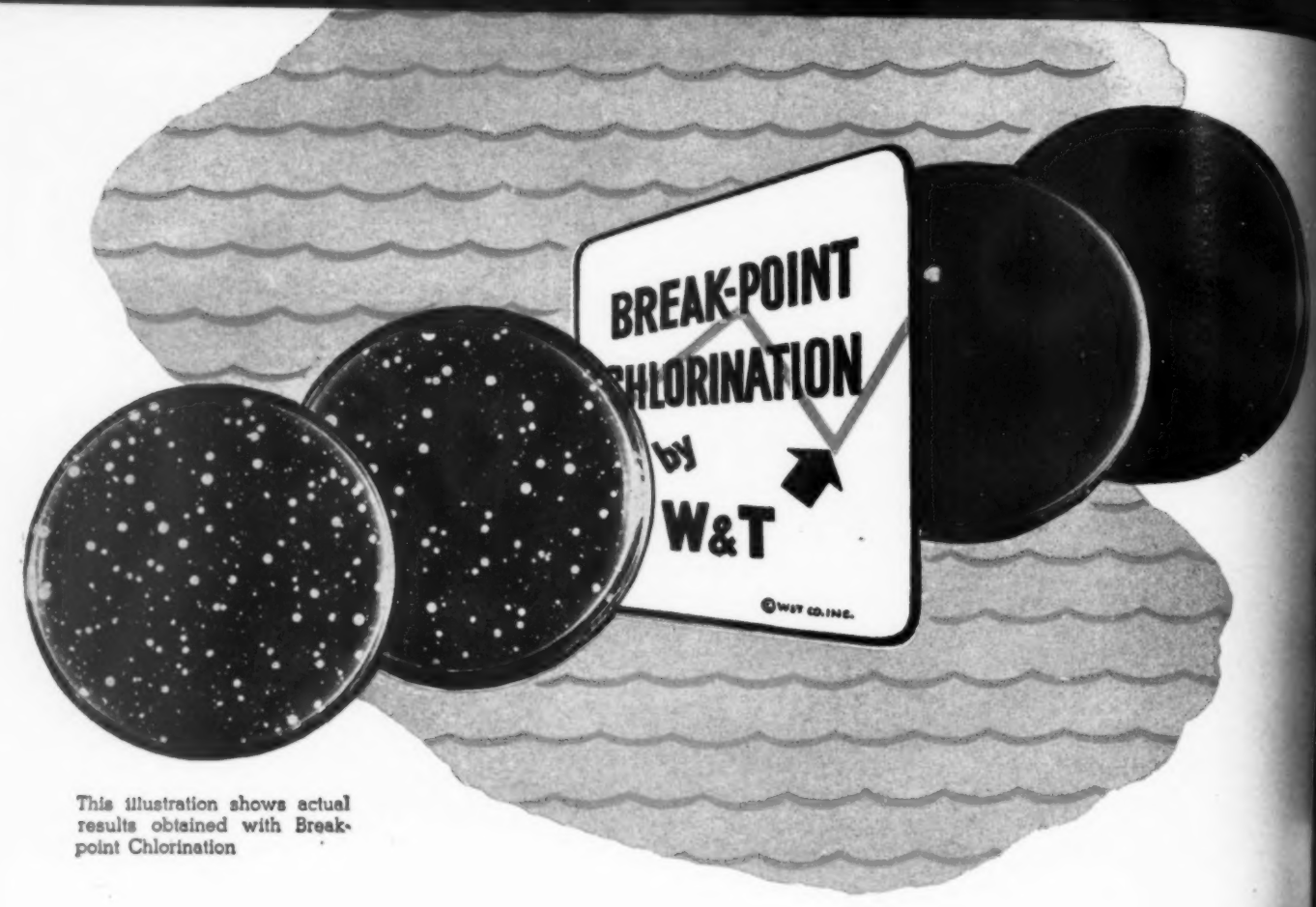
**SUGAR PROCESSING**
PETREE & DORR DIVISION
570 LEXINGTON AVE., NEW YORK 22, N. Y.

Blueprint Manual

**DORR**

RESEARCH ... ENGINEERING ... EQUIPMENT

ADDRESS ALL INQUIRIES TO OUR NEAREST OFFICE




This illustration shows actual results obtained with Break-point Chlorination

# A "Positive" Barrier to "Presumptives"

Free available chlorine residuals are proving again and again that presumptives can be rare as positives — that "water safe beyond doubt", no longer a future ideal, is now a practical accomplishment.

Experience has shown that these residuals — aimed at destroying ALL bacteria, not just the coliform group — are most readily maintained through Break-point Chlorination, which often results in taste and odor reductions too.

Why not call your W&T Representative today for further details and established test procedure for "water safe beyond doubt"?

**WALLACE & TIERNAN COMPANY, Inc.**

Manufacturers of Chlorine and Ammonia Control Apparatus
Newark 1, New Jersey • Represented in Principal Cities

SA-155